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Page 2, line 33, *for* 1875 *read* 1865 and *for* swallow *read* Swatow.

„ 109, „ 30, *for* emeira *read* emeria.

„ 122, „ 12, *for* Agamora *read* Agamura.

„ 146, „ 3, *for* M. B. U. *read* M.B.O.U. '

„ 278, „ 9 from bottom, *for* Perdrix *read* Perdix.

„ 278, „ 4 from bottom, *for* brunneipennis *read*  
*brunneipectus*.

„ 279, „ 5 from top, *for* brunneipennis *read*  
*brunneipectus*.

„ 290, „ 21, *for* Vigros *read* Vigors.

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No. 1, page IV, line 4 from bottom, *for* Gell *read* Gill.

„ 2, „ VI, „ 17, *for* 558 *read* 559.

19, *for* 559 „ 560.

22, *for* 560 „ 561.

26, *for* 561 „ 562.

32, *for* 563 „ 564.

Page 498, line 8 from bottom, *for* rupilala *read* rufilata.

„ 528, „ 20, *for* visalav *read* visala.

„ 544, „ 3, from bottom, *for* thunbergia *read* thunbergi.

„ 544, „ 2, „ „ *for* Dendrognothus *read* Den-  
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„ 559, „ 25, *for* Cerasosphila *read* Cerasophila.

„ 560, „ 1, *for* alpinus *read* alpestres.

„ 562, „ 11, *for* burmannicus *read* burmanicus.

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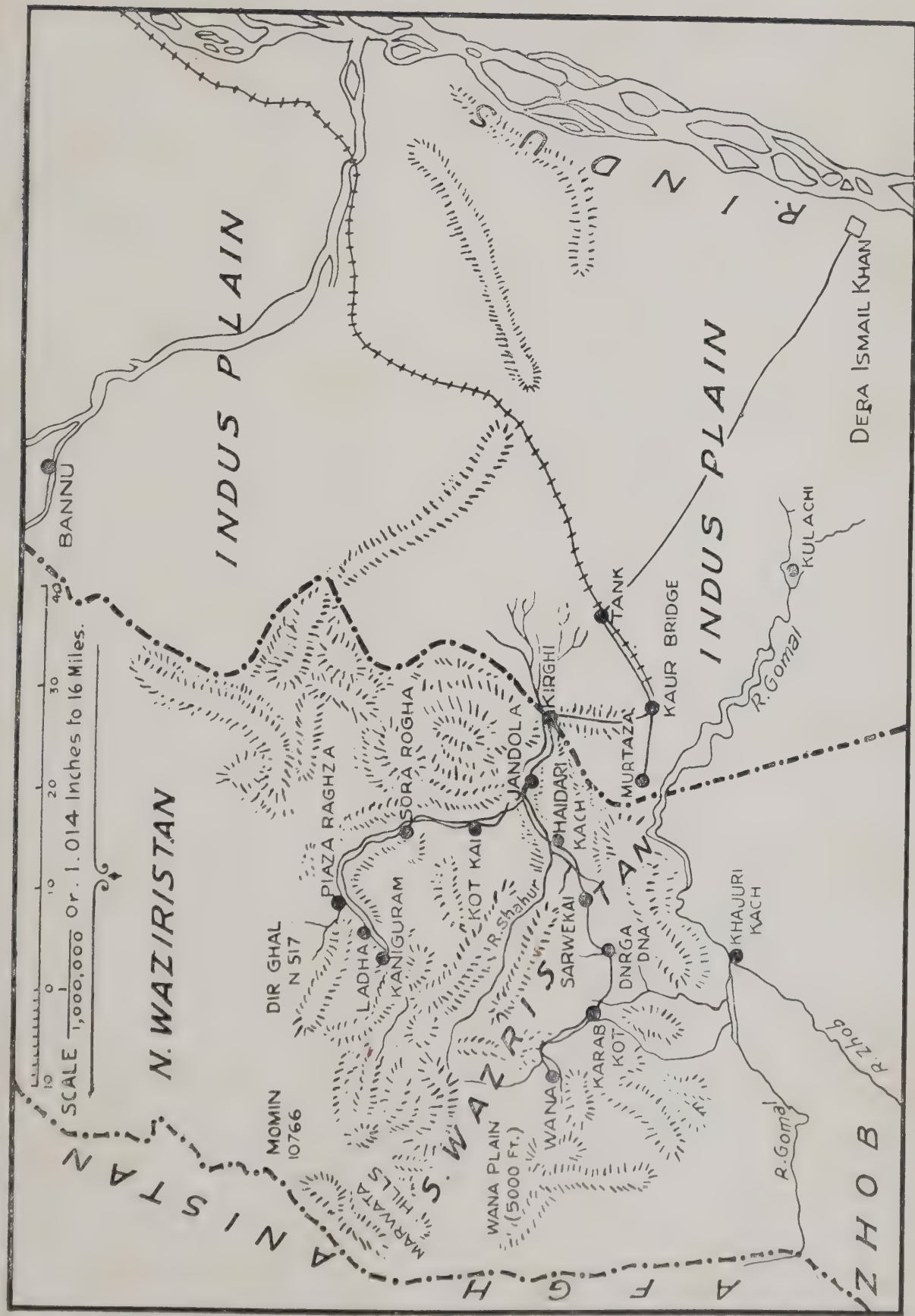


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„ 1009, „ 13, *for* macocercus *read* macrocercus.

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THE PAINTED BUSH QUAIL  
*Microperdix e. erythrorhynchus*







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THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART XXXVII.

(With a plate.)

(Continued from page 597 of this Volume.)

Genus—CRYPTOPLECTRON.

*Cryptoplectron* Streubel, in Ersch. u. Gruber Allg. Encycl. 3, vol. 16, p. 291 (1842). Type *Coturnix erythrorhyncha*, Sykes.

The genus *Cryptoplectron* is very closely allied to *Perdicula*, but differs from that genus in many respects. The tail has only 10 feathers instead of 12; the tarsus is spurless; the bill is decidedly longer and less high, and the wing is shorter and more rounded; the first primary is equal to the 10th, and the 4th, 5th and 6th are sub-equal and longest.

There are only two species known and these are confined to India and possibly, the extreme North-West of Burma in the Chin Hills South of Manipur.

The name *Microperdix* Gould, (B. of A. vii, pl. iii, 1862) by which this genus has hitherto been generally known is unfortunately antedated by *Cryptoplectron*, 1842, and accordingly the latter name must be used.

## KEY TO SPECIES AND SUB-SPECIES.

A.—Upper surface brown with black spots.

a. Throat white.

a<sup>1</sup>. Darker and larger; wing 81 to 92  
mm. . . . . *C. e. erythrorhynchus*.  
♂ p.

b<sup>1</sup>. Paler and smaller; wing 76 to 84  
mm. . . . . *C. e. blewitti*, ♂ p.



b. Throat, chest and breast brick-red.

c'. Darker and larger .. .. . *C. e. erythrorhynchus*,  
♀ p.

d'. Paler and smaller .. .. . *C. e. blewitti*, ♀ p.

B.—Upper surface slaty grey with black bars and spots.

c. Throat chestnut.

e<sup>1</sup>. Upper surface boldly barred with  
black .. .. . *C. m. manipurensis*,  
♂ p.

f<sup>1</sup>. Upper surface with very little black  
marking .. .. . *C. m. inglisi*, ♂ p.

d. Throat dark grey.

g<sup>1</sup>. Upper surface boldly marked with  
black .. .. . *C. m. manipurensis*,  
♀ p.

h<sup>1</sup>. Upper surface only faintly marked  
with black .. .. . *C. m. inglisi*, ♀ p.

CRYPTOPLECTRON ERYTHORHYNCHUS ERYTHORHYNCHUS.

### *The Painted Bush Quail.*

*Coturnix erythrorhyncha* Sykes, P.Z.S., 1832, p. 153, (Karli Valley, N. Konkan); Gray, III. Ind. Zool., II., pl. 44 (1834); Sykes, Trans. Z.S. II., p. 16, pl. I. (1841).

*Perdix erythrorhyncha* Blyth, J.A.S.B., XI., p. 808 (1842), (S. India).

*Perdicula erythrorhyncha* Bonpte., Comp. Rend., XLII., p. 881 (1856); Jerdon, B. of I. III., p. 584 (1863); Bnlger, P.Z.S., 1866, p. 571 (Nilgiris); Blyth, Ibis, 1867, p. 160; Blanf, ibid, 1867, p. 464, (*Sironcha*); Elwes, ibid, 1870, p. 528 (Cardamum Hills, Travancore); Fairbank, S. F. V., p. 409 (1877) (Palni Hills); David. & Wend., VII., p. 82 (1878), (Sholapur, Puna and Satara Hills).

*Microperdix erythrorhyncha* Gould, B. of A., VII., pl. 3 (1862); Hume, N. & Eggs, 1st ed., p. 548 (1873); Fairbank, S. F. IV., p. 262 (1876), (Khandala, Mahableswar).

*Microperdix erythrorhynchus* Hume & Marsh., Game-B., II., p. 123 (1879); Butler, S. F., IX., p. 428 (1880) (Bombay); id. Cat. B. S. Bombay, p. 69 (1880); Davis., S. F., X., p. 411 (1883), (Nilgiris, Mysore, Wynaad); Terry, ibid, X., p. 479 (1887), (Palni Hills); Oates, Hume's N. & E., III., p. 442 (1890); O-Grant, Cat. B. M., XXII., p. 203 (1893); id., Hand. B., Game-B. I., p. 156 (1895); Oates., Man. Game-B., I., p. 100 (1898); Blanf., Avifauna B. I., IV., p. 121 (1898); Davids., J. B. N. H. S., XII., p. 64 (1898), (N. Kanara); Oates, Cat. Eggs, B. M., I., p. 41 (1901); Bourdillon, Jour. B. N. H. S., XVI., p. 4 (1904), (Travancore); C. Primrose, ibid, XXIV., p. 597 (1916), (Nilgiris).

*Cryptoplectron erythrorhynchus erythrorhynchus* Stuart Baker, Hand-L. B. of I. E., p. 199 (1923).

*Vernacular Names.*—*Kokni lowa*, (Hind.); *Kadai*, (Tamil).

*Description, Adult Male.*—Forehead, lores, point of chin and round the eye black; a broad band above the forehead and running back above the eye to the nape, white, sometimes spotted with black; crown black, mixed to a varying degree with brown and always brown on the centre of the occiput; upper parts brown tinged with olive and with large velvety black subterminal spots to each feather; scapulars, wing-coverts and innermost secondaries with white or creamy shaft-lines; the coverts to the outer edge of the wing become more and more cross-barred with rufous; the outer primaries are edged with rufous and the inner primaries barred with the same on the outer webs; the bars become more definite on the secondaries extending across both webs; tail feathers blackish brown, barred with rufous, the bars paler towards the tips; posterior ear-coverts hair-brown; anterior ear-coverts, cheeks, throat and sides of neck white surrounded by a narrow black band; remainder of lower parts chestnut, the upper breast washed with the colour of the back and the feathers sub-tipped with small black spots; sides of the breast, flanks and under tail-coverts with large subterminal blotches of black and with the feathers fringed with pure white.

*Colours of Soft Parts.*—Irides dull grey-brown, (probably in the young only) to brown, a light yellow-brown or hazel (in old birds only); bill, legs and feet rich red. Young birds have bill and legs a duller red, sometimes almost a brownish red.

*Measurements.*—Wing 81 to 92 mm.; tail 38 to 49 mm.; tarsus 25.5 to 27 mm.; culmen 14 to 16 mm. Nearly every specimen in the British Museum has a culmen full 15 mm. or over, but one bird from Travancore has it only 14 mm.

*Female.*—Head and throat with no black or white, these colours being replaced with dull rufous; the black marks on the crown and back are much smaller; the wings are marked with duller and paler rufous; the breast is immaculate rufous, the blotches on the flanks are smaller and there is little or no white on these parts.

*Colours of Soft Parts.*—As in the male, but duller.

*Measurements.*—Wing 84 to 89 mm.

*Chick in Down.*—"Pretty little dark things with three stripes of a very light cream colour extending down their backs." (Miss Cockburn.)

*Distribution.*—South-West India from the South of Travancore Northwards as far as Poona. Eastwards this little quail only extends throughout the various hill ranges of Mysore, Nilgiris, Palni Hills, Cardamon Hills, the Wynaad and throughout the Western Ghats. There is a specimen in the British Museum labelled "Madras".



*Nidification*.—This Little Quail breeds at all elevations throughout its range in suitable localities, that is to say, round about civilization, cultivation and open grassy land where there are also bushes and sufficient cover to hide the nests and eggs. Of nest there is really none at all, for the bird merely scratches a hollow in the ground under the shelter of a tuft of grass, a bush, or even under a clod, rock or boulder. It is apparently never placed in heavy cover of any kind whether tree forest, dense scrub or thick long grass. On the other hand it is occasionally placed practically in the open and not infrequently in among ferns, bushes and grass on the outskirts of gardens and compounds.

The number of eggs laid is not quite definite. Hume certainly accepted 10 as the full complement, and Darling, who was a reliable collector, says that he took as many as this in a clutch. Miss Cockburn gives the number as up to 14 but this may have been recorded merely on the strength of native assertions, notoriously unreliable. Probably 10 is the utmost number ever laid, and that only very exceptionally, the normal clutch being 5 to 7. I have tried for forty years, without avail, to obtain any certain record of anything over 7, and all the collectors who have been so kind as to help me have assured me that they have been unable to find any clutch more numerous than this.

The eggs are miniatures of those of the Grey Partridge, though they average broader in proportion. In colour they vary from almost white to a comparatively warm *café-au-lait* or buff, rarely with a faint olive tinge. They are never as white as are many eggs of *Perdica* and never as deep a tint as some of the deepest eggs of *Francolinus*.

50 eggs average  $31.0 \times 23.0$  mm. and the extremes are:—maxima,  $34.3 \times 24.0$  mm. and  $31.1 \times 24.3$  mm.; minima,  $28.1 \times 22.4$  mm. and  $31.0 \times 22.0$  mm.

It is difficult to define the breeding season; probably August to October are the favourite months, but in Travancore Bourdillon took eggs in January and February and again in July to September and in December; in the Nilgiris they breed from January to March again August to November and I have also 3 eggs taken at Kotagir in June. These Quails certainly breed twice in the year but probably most birds breed according to the monsoons, laying after the first break of the rains when insect life is most plentiful and the young when hatched are easily fed.

There appears to be nothing on record as to the male Painted Bush Quail's domestic habits; whether he is polygamous or monogamous; what part, if any, he takes in incubation or looking after the young, etc. Judging from its pugnacity alone one would expect it to be polygamous, at the same time, as both parents are found with the coveys after they are hatched it is probable that it is monogamous.



*Habits.*—The Painted Bush Quail seems to be found wherever the ground is broken up into low foothills and ravines and from these up to at least 6,000 feet or higher. It is common in the plateaus at 2,000 feet when these are not too flat or too densely covered with forest but it is not found in the true plains countries. It resorts to thin scrub, light deciduous forest with scanty bush and grass undergrowth, but its favourite resorts are cultivated tracks interspersed with patches of cover and with others of open waste land. Mr. A. P. Kinloch records it as being very numerous in the Lily Downs in Cochin Nelliampatty at 4,700 feet, being found round the edge of every *shola*. He writes :—

“These pretty birds are absurdly tame and seem even more deficient in intelligence than most Gallines. By sitting on a rock a few yards from the *shola* edge early in the mornings or late in the evenings and keeping still, I could repeatedly have knocked these birds over with a stick. They came within a couple of feet of my boots on one occasion.”

In the mornings and evenings it wanders about in the open, often on roadsides, in gardens or in cultivated fields and, except when breeding, is found in little coveys of half-a-dozen to a dozen birds, evidently consisting of the old birds and their last brood, two families combining their forces in a few cases. In the heat of the day they seek shelter among bushes, grass or high crops and are then very hard to flush without a dog and, even with such help, they are very loth to rise again a second time.

They appear to be tame little birds and even when feeding in the open they will often run along in front of the disturber rather than take to wing, finally scuttling into the nearest cover when the danger comes too close.

Like the rest of our Indian Game-Birds, especially the more pugnacious ones such as this bird is, it suffers from the attentions of snarers and bird-catchers of all kinds. They are caught in the Nilgiri bait traps as described by Miss Cockburn, who writes :—

The natives often rear these Quails as decoy birds. They make small square bamboo cages. In the centre is a small square compartment, in which the decoy bird (male or female) is confined. Little bars run from each corner of this inner compartment to the inner corner of the cage, thus dividing the space which runs all round the former into four verandahs, if I may use the word. The outer sides of these, in fact of the cage itself, let down, and are so arranged that, by the pressure of the bird's feet on the bars, which form the floor of the verandah, they start up again, and enclose whatever is in that particular verandah. Spring cages of this nature are in use, I believe, in many parts of India, though the arrangements for springing the sides vary a good deal.

"The cage, the spring sides duly set, is placed on the ground in some locality where the wild birds are common. The owner hides himself behind a bush, and begins to imitate the bird's note by whistling like them. Instantly his own bird begins to call, and the wild ones all around answer it. In a few minutes these surround the cage, and rush into the verandahs to get at the decoy bird; the spring sides fly up and close with a click, and the would-be combatants are captured. Hearing the sound, the Quail-catcher runs out, transfers the captured bird to his netted bag, re-sets the spring sides, and repeats the process."

Other methods she describes as follows:—

"Sometimes, in addition to the spring cage, a small bamboo frame-work of varying length, and 3 or 4 inches in height, is placed upon the ground in a zigzag shape, partly or entirely surrounding the cage, and distant from it 2 or 3 feet. This little fence is pierced by numerous apertures (just large enough to allow the bird to pass), to each of which is attached a horse-hair noose. As this Quail prefers creeping through any hole to flying over any obstacle, however low, many which escape the spring cage are caught in the nooses.

"When the natives come across a very young brood, they catch two or three of them, and put them into a hole about a foot deep, which they dig in the ground. The parent birds, finding that the young ones cannot come out to them, very soon drop into the hole, when the native, who has been watching from behind some bush, creeps softly up, throws a cloth over the hole, and captures them."

Their flight is like that of the ordinary Quail, very direct and straight but much less noisy. They rise at one's feet and whiz away in a bee-line from the intruder, and then tumble headlong into cover; sometimes the whole covey rises all together, scattering in every direction, at other times they rise singly at intervals but eventually they all collect again together, calling continuously in a soft low whistle. Their ordinary call is a whistle which Davison syllabifies as tu-tu-tu-tu-tutu-tutu, etc., and which he says is very ventriloquistic, sometimes sounding far away and at other times as if almost at one's feet.

They feed on grain, seeds and small insects but the young are at first fed almost entirely on the latter. Although so tiny, they are by no means to be despised as an article of diet, their meat being very white and sweet if rather dry.

CRYPTOPLECTRON ERYTHORHYNCHUS BLEWITTI.

*Blewitt's Bush Quail.*

*Perdicula erythrorhyncha* Ball (Nec. Sykes). Str. Feath., II., p. 428 (1874), (Chota Nagpur and Satpura Hills).



*Microperdix blewitti* Hume, S. F., II., p. 512 (1874), (Raipur); Ball, *ibid*, III., p. 294 (1875), (Chota Nagpur and Satpura Hills); Ball, *ibid*, VII., p. 225 (1878), (Sirguja, Raipur, Nowagarh and Karial); Hume & Marshall, Game-Birds Ind., II., p. 130, pl. (1879); Ogilvie-Grant, Cat. Birds B. M., XXII., p. 204 (1893); Ogilvie-Grant, Hand-B., Game-B. I., p. 158 (1895); Oates, Man. Game-B. India, I., p. 104 (1898); Blanf., Faun. Brit. Ind. IV., p. 122 (1898).

*Cryptoplectron erythrorhynchus blewitti* Stuart Baker, Hand-L. B. of I. E., p. 199 (1923).

*Vernacular Names*.—*Sersee-lawa* (Mundla, Balaghat, Chanda).

*Description, Adult Male*.—Similar to *M. e. erythrorhynchus*, but generally paler and duller; the black gorget round the white throat is very broken; the white sincipital line is broader, and the black forehead narrower; the brown-grey wash on the breast is stronger and comes lower down and there is more white on the feathers of the flanks.

*Colours of Soft Parts*.—"Iris brown; bill, legs and feet coral-red". (Hume).

*Measurements*.—Wing 76 to 84 mm.; tail 39 to 44 mm.; tarsus about 26 mm.; culmen 13 to 14 mm.

*Female*.—Differs in degree of colouration from that of the Painted Bush Quail as does the male.

*Measurements*.—Of the few sexed females available these are much the same as in the male.

*Immature Birds* are like the female but show considerable white shaft-lining, both on the breast and upper back. Young males soon acquire the black on the crown.

*Distribution*.—Central Provinces, North and East of the range of the preceding bird, having been found in Mandla, Balaghat, Seoni, Chandpur, Raipur, Sironcha and Bastar; it occurs round about the Sambalpur District on the East and thence North-East through Manbhum and Singbhum to Hazaribagh.

*Nidification*.—There is nothing on record about the nidification of this Quail, but 3 eggs sent me from Chanda in the Central Provinces as those of *C. e. erythrorhynchus* are undoubtedly those of this bird. They were taken on the 31st August 1889, and were said to have been laid in a scratching in thin Sal-tree and scrub jungle. Possibly on account of their age they are somewhat discoloured, but they certainly appear duller and are more olive-tinted than any eggs I have seen of the typical form. They measure  $30.5 \times 24.0$ ;  $32.0 \times 23.0$ ; and  $30.0 \times 23.4$  mm. A series would probably differ from those of the Painted Bush Quail in averaging somewhat smaller. According to Mr. Blewitt (*vide infra*) the breeding season is from November to January, but Mr. R. Thompson says that the breeding season begins in June-July, and that young birds are on the wing by September. I twice came across this little Quail on the Ranchi District of Chota



Nagpore, and in both cases the coveys were of full-grown birds, but this was in May and June, possibly before they had begun to think of domestic duties.

*Habits.*—There has been absolutely nothing recorded about this Quail since the days of Hume and Marshall, when Blewitt wrote :

“This really pretty Bush Quail is extensively distributed throughout the forest tracts and scrub jungle bordering the various low hill ranges in the districts of Raipur and Bhandāra, and more sparsely in similar localities in the South-Western sections only of the Sambalpur District. I do not believe it exists in the other half, at least my men and I never secured a specimen. It also affects, at certain seasons, grass patches and fields near hills or jungle.

“This Quail is invariably found associated in coveys of from four to a dozen, and even more. A bevy will, when suddenly alarmed, rise all together, but, owing to their softer plumage, with a less noisy whirr than the other Bush Quails. Indeed in its habits this species is identical with the others; if there is a difference, it is in the call notes, which, in *M. blewitti*, is more soft and melodious. When feeding, chiefly in the early mornings and evenings, they run actively about, diligently searching for and picking up seeds of sorts and insects. From the statements of the villagers and others, the period of nidification would appear to be from November to January. It was some time in the former month or December that my men brought certain Quail eggs, which they positively stated to be of this species, but *without* the parent bird. There is, however, this fact to be noticed, that very young birds were shot and snared in February and March in the Raipur district. This Bush Quail is netted in great numbers in the cold and hot seasons. The flesh is very delicate and well flavoured.”

The few birds we saw in Ranchi were in flocks of about 7 or 8 birds, and were put up, one flock out of a millet field, the other out of mixed Sal and scrub jungle which we were beating for Spur Fowl. My father bagged four birds out of the two flocks and I manfully missed the lot. The birds rose like Quail, one or two at a time, and not as Mr. R. Thompson says his did, *en masse*. They flew fast and straight, but not far, and tumbled down as if shot after flying for fifty to sixty yards, in fact they flew much as Common Quail fly but with a much softer *whirr*. They called a rather loud short whistle when rising and, after settling, again called to one another with a very soft, low little note.

Mr. Thompson says they soon become tame in captivity and make charming pets, but that the males are very pugnacious.

## CRYPTOPLECTRON MANIPURENSIS MANIPURENSIS.

*The Manipur Bush Quail.*

*Perdicula manipurensis* Hume, S. F., IX., p. 467 (1880), (Bases of Eastern Manipur Hills); Hume, *ibid*, XI., p. 309 (1888).

*Microperdix manipurensis* Ogilvie-Grant, Cat. B. M., XXII., p. 204 (1893); *id.*, Hand-B., Game-B. I., p. 159 (1895); Oates Man. Game-B. I., p. 107 (1898); Finn, Ibis, 1899, p. 472 (Manipur); Wood, J. A. S. B., LXVIII., pt. 2, p. 110 (1899), (Manipur); Connor, J. B. N. H. S., XVIII., p. 496 (1906); Higgins, *ibid*, XXII., p. 399 (1913), (Manipur).

*Microperdix manipurensis manipurensis*, Stuart Baker, Hand-L.B. of I. E. p. 200 (1923).

*Vernacular Names.*—Lanz-Soibol (Manipur).

*Description, Adult Male.*—Forehead, round the eye, cheeks, chin and throat deep rufous chestnut; lores, a line through the eye and a spot behind the ear-coverts white; ear-coverts brown; the whole upper plumage dark slaty-grey barred throughout with velvety black; the bars becoming bold black patches on the scapulars and inner secondaries: quills dark brown, the outer primaries edged with buff and the inner primaries and outer secondaries barred with the same; neck and upper breast ashy grey with black centres, lower breast and abdomen rufous buff, more grey on the flanks and each feather with a black cross formed by a black shaft line and broader cross bar; under tail-coverts black, tipped and spotted with white.

*Colours of Soft Parts.*—Iris dark brown or hazel; bill dark grey, paler and yellowish at the base; legs and feet orange red to deep vermilion red, probably darker and redder in the breeding season than at other times; claws light brown.

*Measurements.*—Wing 80 to 86 mm.; tail 45 to 52 mm.; tarsus about 25 to 26 mm.; culmen 14 to 15 mm.

Weight 2.28 to 2.65 ozs.

*Female.*—Like the male but duller and paler and without any chestnut on the head; the rufous below is replaced by pale greyish buff and the centre of the chin and throat is very pale grey.

Weight 2.37 to 2.94-ozs.

*Distribution.* Manipur, Cachar, Naga Hills and Khasia Hills.

*Nidification.*—The only note recorded about the nesting of this bird is that of Captain H. S. Wood, quoted further on, given in the Journal of the Asiatic Society of Bengal, 1899, p. 110, but these eggs were probably those of a Bustard Quail. Once, however, I was so fortunate as to take their eggs myself.

On the 13th May 1899 whilst marching over the grass-covered hills on the Lere-Baladhun road in North Cachar one of these Quail rose from a patch of rather thin short grass, not more than a couple of feet high, almost at my feet. After bowling it over and picking it up I returned to my original position and hunted round on the off chance of a nest. A few minutes' search revealed to my delight



four almost white eggs snugly ensconced in a hollow scratched in among the roots of the sun grass. There was no nest though a few scraps of grass and leaves lay scattered in the hollow where the eggs lay, points inward, as in the manner of Plover's eggs. These, the eggs, are whiter than any I have seen of *Cryptoplectron erythrorhynchus* and are not so pointed in shape. They measure  $30.4 \times 24.1$ ;  $31.2 \times 23.5$ ;  $31.2 \times 24.0$  and  $29.3 \times 24.9$  mm.

*Habits.*—There is so little on record about the Quail that I quote fully Hume's original note on his find. He writes:—

“Once, and once only, did I meet with this species, and that was near the bases of the hills in the South-Eastern portion of the Manipur Plain.

“There were two coveys—one of 6 and the other of 5—feeding in the very early morning in a tiny patch of ground a few yards square, thickly covered with large tufts of freshly springing elephant grass. This patch had recently been burnt; probably it had been fired by design, but the fire had not spread, and all around for many hundreds of yards stretched a dense unbroken thicket of elephant grass, 15 feet high, and so thickly set that it was next to impossible to force one's way through it. I did not see the birds myself as I was a few yards to the right, but two of my people, on whom I could rely, saw them distinctly as they ran into the high grass, and described them to me as small blackish Partridges of an *unknown* kind.

“There were about two square miles of high grass covering very uneven and broken ground, and it seemed hopeless to beat it, as we had no elephants and no dogs. So sending everyone away quietly, I ensconced myself in the high grass on the opposite side of the little opening to the place at which the birds had disappeared, and stood patiently waiting for about two hours. When it became too late to hope for their reappearance (this kind of bird rarely feeds in the open after 9 a.m.), I recalled my men and set to work to try and burn the grass, as a good breeze was blowing; but after an hour thus wasted, we had to abandon the attempt. The fire would not spread, the grass was nearly dry, it had lost, I mean, all greenness, and nearly all natural moisture, but it had rained incessantly for the previous three days and nights and was still drizzling, and everything was too sodden to take fire. Naturally, I was not going to move until I did get a specimen, so my whole camp, soldiers and sailors (we had a lot of boatmen), camp followers, and all the inhabitants of the viliage were turned out. First we tried cutting, but it soon became obvious that this would be too long a job. So we set to work to divide off the expanse into a number of irregularly sized patches, and this the configuration of the ground with its several ridges, along the crests of which the grass



grew comparatively thinly, greatly facilitated. Although we had fully one hundred men working with their heavy hatchet-swords (*dahs* as the Burmese call them), and working, as only these Easterns can, at trace cutting, it was some hours before we had got the ground into shape, and fully three o'clock before beating commenced. At dusk, by dint of our united efforts, I had knocked over six, of which we had failed to retrieve one. The first bird had convinced me that the species was new to me, and what still more surprised me was that the villagers one and all denied having ever previously seen the bird. We were one and all exhausted with pushing through and through the thicket, and were so cut and scratched by the grass and bruised with stumbles in the broken ground that we were scarcely able to get back to our huts. But I had been very lucky. I had dropped every bird that rose, some of them very difficult shots. They had risen singly and at long intervals.

"Next day I let every one have a long sleep, a good breakfast and a good smoke, and by 10 a.m., we were again in the grass. By 3 o'clock I had knocked down five more, of which, however, we failed to find one. After that we saw no more, and I fully believe that there *were* only the two coveys of 6 and 5 respectively seen and counted by my people. I have had many hard days shooting in my life, but never any harder than these two.

"But what can we think of the bird? Can it really have been a purely accidental straggler from further East? Not only did the villagers of the place declare that they had never previously seen it, but the same was said in many other villages where I showed skins of it. Moreover, though I beat numbers of other seemingly suitable spots, I never saw another. On the other hand I never again had one-tenth of the number of men beating any patch of grass that I had on those two days, and no bird ever rose on that occasion until it chanced to get so hemmed in between half-dozen beaters that no other alternative remained to it, and about ten days after I shot my nine birds, one of my men saw and shot one in the early dawn just as it was retreating into a patch of grass, also at the foot of the Eastern Hills, but about 50 miles further North.

"I never heard it call, though certainly the birds go normally in coveys, and we separated the individuals composing these widely enough.

"Those killed had fed on grass seeds, pods of a tiny wild lentil, and ants of various colours. In one there were tiny black fragments that looked like portions of the wing-cases of some coleopterous insect."

Major Woods writes of this Quail :—

“ During my seven years of residence in Manipur I must have shot over 80 birds of this species there. It is by no means such a rare bird as Hume thinks . . . . The Manipuri name for this bird is *Lanz-Soibol*, literally, the Trap Quail, as the Nagas snare this bird in nooses after the jungle fires. These birds breed in Manipur; the egg as in all the Quail tribe is very large in proportion to the size of the bird, and is of a greenish colour, blotched with patches of brown and black. The nest is merely a hole scratched in the ground and there is no particular nest formation. I have only seen these birds at certain seasons of the year, during the rains and before the jungle fires. They keep to very dense jungle composed entirely of sun and elephant grass, and as they are great runners they are very hard to see. It is only after the jungle fires from February to April that one sees these birds in any quantity. They are always in coveys varying in number from 6 to 8. They are great runners and at first look like black rats running along the ground and are hard to see in the burnt grass the colour of which they so resemble. They will rise readily to dogs and after a short flight drop again into any patch of unburnt grass. I found them in greatest abundance in jungles adjoining nullahs in which there was a certain amount of water,—in fact they are always found close to water. Their call is a low whistle, soft in character, and this is heard chiefly in the evening after one has been firing the jungle, apparently a call for the assembly, . . . . . I have never seen this bird in the low hills. They are associates of the Common Francolin and where one is found the other is also in the locality. When running they keep very close to each other; in this way I have bagged as many as 4 in a single shot.”

Mr. J. Higgins, C. S., also sends me the following interesting note on this Quail :—

“ I bagged 88 Hume's Bush Quail during the nine years I was in Manipur, 4 in the first five years and 84 in the last four when I had learnt more about their haunts. My best year produced 36 birds, and on my two best days I bagged 14 and 13 birds respectively, both days shooting in the same locality, at the foot of the hills on the East of the Imphal Valley, near where Col. Wilson got his Wood Snipe. They are to be found anywhere in the Manipur Valley where there is long grass and water, but almost exclusively round the edge of the valley, near the hills, and away from the populous portion of the country. They run in coveys up to a dozen and generally when first disturbed all rise together and then break up and scatter when it is difficult to flush them again, though they do not seem to run far. One day when shooting with Col. Cole we came on a piece of grazing ground



and stream that was thick with different kinds of Quail and we shot 13 Blue-Breasted Quail, 4 Bustard Quail, 9 Hume's Quail and 2 *Turnix communis-japonica*. We were shooting with beaters and dogs, and one covey of Hume's Bush Quails furnished us with excellent sport. This particular covey instead of rising all in a bunch got up by ones and twos flying right across us so that we succeeded in shooting and picking up nine out of the whole covey of eleven.

"In the open they fly strongly and at a fair height, 6 or 8 feet off the ground. In long grass, however, or a jungly stream they soon drop and give rather difficult shots. I have not noticed them when running, so cannot say if they separate or keep together.

"The flesh of Hume's Bush Quail, which is distinctly a table bird and nearly as big as a Common Quail, is pure white throughout, and I consider it the best eating bird I know, better than Florican, Garganey Teal or Jungle-Fowl.

"I never saw it out of the Manipur Valley and its tributary valleys."

#### CRYPTOPLECTRON MANIPURENSIS INGLISI.

##### *Primrose's Bush Quail.*

*Microperdix inglisi* Ogilvie-Grant, Journal B. N. H. S., XIX., p. 1 (1909), (Goalpara, Assam); Inglis, *ibid.*, pp. 2, 3; *id.*, XIX., p. 993 (1910); *id.*, *ibid.*, XXVII., p. 151 (Jalpaiguri, Bengal).

*Microperdix manipurensis* Thornhill, Journal B. N. H. S., XV., p. 527 (1904), (Alipur Duars).

*Microperdix manipurensis inglesii* Stuart Baker, Hand L. B. of I. E. p. 200 (1923).

*Vernacular Names.*—*Kala Goondri* (Assamese).

*Description, Adult Male.*—Differs from *C. m. manipurensis* in being somewhat paler and less boldly marked with black both above and below.

*Colours of Soft Parts.*—"Bill dark grey, base of mandible lighter and in some specimens this is tinged with yellow; tarsus orange-red, toes and back of tarsus lighter, claws light brown. Iris brown." (C. M. Inglis).

*Measurements.*—The same as in *C. m. manipurensis*.

*Female.*—Differs from the female of *C. m. manipurensis* in being paler and more grey and in having the black markings smaller and less conspicuous.

*Colours of Soft Parts.*—As in the male.

*Young.*—Browner than the adult, but more heavily marked with black. Bill above dark grey, with pale tip and base to lower mandible; tarsus fleshy.

*Distribution.*—The foot hills and adjoining plains of the Eastern Duars, Jalpaiguri, through Assam North of the Brahmaputra as far East as Sadiya where a specimen was shot by Mr. J. Needham.



*Nidification*.—Unknown.

*Habits*.—This bird was first obtained by Thornhill in the Alipur Duars and identified as *M. manipurensis*. Later several were obtained by Mr. A. M. Primrose and Mr. Ch. M. Inglis, specimens being sent home by the latter which were named after him by Mr. Ogilvie-Grant.

Mr. Inglis thus writes about this little Quail :—

“This Quail is the commonest quail got in that garden” (Mornai in Goalpara), “but on account of the nature of the jungle it frequents it is seldom seen and is difficult to get. They are found in damp, dense ekra jungle which grows in the nullahs, and when these get inundated during the rains, they move into higher pieces of ekra and also into the sungrass. We have never seen them on absolutely dry ground except when feeding ; at other times they keep exclusively to the damp nullahs. Our observations are mostly confined to the cold weather, and up to April, as after that the jungle is too heavy to walk through or have beaten. They are excessively local birds, only certain patches of jungle holding them, and they frequent the same spot year after year. Although there may be, what appears to us, identical patches of ekra in the same nullahs and which one would think should contain these quails still none will be found in them. One soon gets to know which patches are worth beating and which not. Many of these birds must get destroyed in the fierce fires which rage in that part of Assam during the early part of the year. A good method of getting these birds is as follows :—

“A day or two before the beat takes place burn patches in the nullah, leaving those which contain the birds. This has to be done carefully. This thinning of the jungle gives one a better chance, as it gives the birds fewer places to put up in when flushed and also fewer wounded birds get lost. Without doing this it is very difficult indeed to retrieve wounded birds as they run a lot and have a knack of getting over the ground at a good pace. A good dog or two would of course be of great service both for retrieving and putting up the birds. Burning the grass in front of one as one goes along is of no use, as the birds only run before or else through the fire and will not take to flight. They are usually seen in coveys of 4 to 6, but during March and April they collect into larger ones from 6 to 12 birds or perhaps even more. On the 28th March Mr. Primrose wrote that they were *exceedingly plentiful* and that he picked up 4 during one evening’s stroll. The coveys separate on being disturbed, some flying ahead and others back over the beaters. They are not difficult to flush a second and even a third time with a sufficient quantity of good beaters. At first they rise up into the air and they go off with a straight, steady flight, for about 50 yards and then drop suddenly. This habit they have of thus

dropping often makes one believe one has missed one's bird instead of which it is probably stone dead where it fell, whereas those one thinks are killed have merely dropped and run away. On touching the ground they either start running at once or else if the beaters are close up they will squat. It is most difficult to spot them either running over or squatting upon the burnt grass, for their colour matches that of the ash most perfectly. When they squat they sit very closely being sometimes picked up alive by the beaters. Their note is like that of the Painted Bush Quail (*Microperdix erythrorhynchus*) and is often uttered when the covey separates. As far as we could observe, males outnumbered females. Their food consists principally of seed. They are very occasionally flushed from the edges of the tea. We on several occasions came upon coveys feeding in the open on the burnt ground up to about midday and probably during dull weather they feed there all day. With fair luck and straight powder, two men, one taking each side of the nullah, ought to be able to account for every bird in it. Our biggest bag for a morning was 8 birds, but that I am certain could be easily beaten in a place like Mornai. They are known by the name of *Kala goondri* at Mornai Tea Estate where all our specimens were obtained. Adults showed signs of breeding in the beginning of March, and we were fortunate enough to obtain a fully fledged young one on the 11th January."

(To be continued.)

# A HAND-LIST OF THE SNAKES OF THE INDIAN EMPIRE.

By

F. WALL, C.M.G., C.M.Z.S., F.L.S., F.A.S.B., H.C.Z.S.I.,  
COLONEL, I.M.S.

(Continued from page 632 of this Volume.)

## PART III.

Family.—COLUBRIDÆ—(Continued.)

Subfamily.—COLUBRINÆ.

- 205 (368) **Liopeltis scriptus** (Theobald.) *Theobald's Smooth Snake*.  
*Ablabes scriptus*. Boulenger, *Cat. Vol II*, 1894, p 284 ; *Sclater List Sn. Ind. Mus.*, 1891, p 18.  
*Type*.—In the Indian Museum from Martaban.  
*Length*.—451 mm. (1 foot,  $5\frac{5}{8}$  inches). *Tail*, 145 mm. ( $5\frac{3}{4}$  inches).  
*Lepid*.—Costals. In 13 rows in the whole body length. *Ventrals*. 146. *Anal*. Divided. *Subcaudals*. 88.  
*Distn*.—Burma. Martaban.  
*Note*.—Malcolm-Smith's authority for the Malay Peninsula. North of Kra, is not known to me.
206. (Nil.) **Liopeltis stoliczkae** (Sclater.) *Stolizcka's Smooth Snake*.  
*Ablabes stoliczkae* Boulenger, *Cat. Vol II*, 1894, p 281 ; *Sclater, List Sn. Ind. Mus.* 1891, p 18 ; *Wall, Bomb. N. H. J. Vol XIX*, p 350.  
*Lepid*.—*Ventrals*. 148 to 154.  
*Distn*.—*Eastern Himalayas*. Sikkim. (Darjeeling Dist. F. W. Mungpoo. Bombay colln.) *Assam*. Naga Hills. (Samaguting. Ind. Mus.) *Burma*, Karen Hills (Bia-po.)
207. (370) **Liopeltis doriae** (Boulenger.) *Doria's Smooth Snake*.  
*Ablabes doriae* Boulenger, *Cat. Vol II*, 1894, p 279 ; *Sclater, List. Sn. Ind. Mus.* 1891, p 18.  
*Lepid*.—*Ventrals*. 160 ? to 187. *Subcaudals*. 74 to 80.  
*Distn*.—*Assam*. (Boulenger.) *Burma*. Kachin Hills. Manipur. (Ind. Mus.) *China*. Yangtse Valley (F. W.).
208. (369) **Liopeltis frenatus** (Günther.) *Jerdon's Smooth Snake*.  
*Ablabes frenatus* Annandale, *Rec. Ind. Mus.* 1912, pp 37, 47 and 53 ; *Boulenger, Cat. Vol II*, 1894, p 280 ; *Sclater, List. Sn. Ind. Mus.* 1891, p 18 ; *Wall, Bomb. N. H. J. Vol XVIII*, p 328.  
*Lepid*.—*Subcaudals*. 87 to 97.  
*Distn*.—*Assam*. Abor Hills. Khasi Hills. *Burma*. Mansi. (Lat.  $24^{\circ}7'$ . Long.  $95^{\circ}7'$ . Bombay colln.)  
*Note*.—Boulenger has already questioned the authenticity of the localities of specimens labelled Afghanistan and Mesopotamia in the British Museum. Murray refers to a specimen from Sind. (*Vert. Zool. Sind.* 1884, p 376.) The specimen was not in the Quetta



Museum when I examined the collection nor in the Karachi Museum. This collection includes snakes from many parts of India, such as *Plectrurus perroteti*, *Silybura ocellata*, *Cylindrophis rufus*, etc. Sind is to be discredited. I have seen one specimen in the Indian Museum from Assam, and acquired six, three from Shillong, and three from Cherrapunji.

209. (367) **Liopeltis calamaria** (Günther.) *Günther's Smooth Snake.*

*Ablabes calamaria.* Boulenger, *Cat. Vol II*, 1894, p 282; Sclater, *List. Sn. Ind. Mus.* 1891, p 18; Ferguson, *Bomb. N. H. J. Vol XIV*, p 386; Pearless, *Spol. Zeylan.* 1909, p 54; Sarasin, *Zool. Jahr. Jena.* 1910, p 128; Wall, *Bomb. N. H. J. Vol XXVI*, p 569; Willey, *Spol. Zeylan.* 1906, p 233.

*Liopeltis calamaria.* Wall, *Oph. Tap.* 1921, p 251.

*Lepid.*—Ventrals. 126 to 163. Subcaudals. 53 to 76.

*Distn.*—*Eastern Himalayas.* Buxa Dooars. (Bombay colln.) *Western Himalayas.* Songara, Gonda Dist. Kurkhana, Pilibhit Dist. Melan-ghat, Almora Dist. (Ind. Mus.) *Hills of Peninsular India.* Surguja, Chota Nagpur Dist. (Ind. Mus.) *Western Ghats.* (Mahableshwar, Bombay colln. Mysore Plateau. F. W. Tinnevely. Ind. Mus.) *Ceylon.*

210. (371) **Liopeltis rappi** (Günther.) *Rapp's Smooth Snake.*

*Ablabes rappi.* Boulenger, *Cat. Vol II*, 1894, p 282; Sclater, *List. S. Ind. Mus.* 1891, p 19; Sarasin, *Zool. Jahr. Jena.* 1910, p 146; Wall, *Bomb. N. H. J. Vol XIX*, p 351.

*Lepid.*—Subcaudals. 60 to 76.

*Distn.*—*Western Himalayas.* Simla. (Ind. Mus.) *Eastern Himalayas.* Nepal to Sikkim.

211. (Nil.) **Liopeltis hamptoni** (Boulenger.) *Hampton's Smooth Snake.*

*Ablabes hamptoni.* Boulenger, *Bomb. N. H. J. Vol XIII*, p 553.

*Type.*—From Mogok, in the British Museum.

*Length.*—1,050 mm. (3 feet, 5 $\frac{3}{8}$  inches). Tail, 220 mm. (8 $\frac{3}{4}$  inches).

*Lepid.*—Costals. In 15 rows at midbody. Ventrals. 194. Anal. Entire. Subcaudals. 76.

*Distn.*—*Burma.* Mogok, Ruby Mines.

212. (372) **Liopeltis nicobariensis** (Stoliczka.) *The Nicobar Smooth Snake*

*Ablabes nicobariensis.* Annandale, *J. A. S., Beng.*, 1905, p 175; Boulenger, *Cat. Vol II*, 1894, p 285; Sclater, *List. Sn. Ind. Mus.* 1891, p 19.

*Type.*—In the Indian Museum from Camorta.

*Lepid.*—Ventrals. 188 on right side, 186 on left. Subcaudals. 86.

*Distn.*—*Nicobar Islands.* Camorta. (No 7201. Ind. Mus.)

Genus.—*CALAMARIA* Boie.

213. (332) **Calamaria pavementata** Dumeril and Bibron. *Dumeril's Snake.*

*Boulenger, Cat. Vol II*, 1894, p 348; Prater, *Bomb. N. H. J. Vol XXVI*, p 684; Wall, *Bomb. N. H. J. Vol XXVI*, p 866.

*Lepid.*—Ventrals. 140 to 200.

*Distn.*—*Assam.* Garo Hills. (Tura. Bombay colln.) *Burma.* Chin-Hills. Pegu. (? Hills.) *Siam.* Indo-China. Lao Hills. *China.* Canton. Yangtse Valley. *Malay Peninsula.* Penang Hill. Pahang. Perak. Prov. Wellesley. *Malay Archipelago.* Java.

## Series.—OPISTHOGLYPHA.

## Sub-family.—HOMALOPSINÆ.

## Genus—HYPSIRHINA Wagler.

214. (466) **Hypsirhina plumbea** (Boie.) *Boie's Water Snake*.  
*Hypsirhina plumbea*. Boulenger, *Cat. Vol III*, 1896, p 5; Sclater, *List. Sn. Ind. Mus.* 1891, p 54.  
*Lepid.*—Ventrals. 117 to 139.  
*Distn.*—Burma. Mandalay. (Stoliczka.) Pyawbwe and Rangoon (Bombay colln.) Thayetmyo. (Theobald.) Meiktila. (F. W.) Siam. Patani. Pachebone. Indo-China. China. Southern Provinces and Coastal Islands. Formosa. Malay Peninsula. Penang. Tahkamen. Malay Archipelago. Java. Borneo. Celebes.
215. (467) **Hypsirhina enhydrys** (Schneider.) *Schneider's Water Snake*.  
*Helicops indicus*. Annandale, *J. A. S., Beng.*, 1905, p 211.  
*Hypsirhina enhydrys*. Boulenger, *Cat. Vol III*, 1896, p 6; D'Abreu, *Bomb. N. H. J. Vol XXII*, p 203; Sarasin, *Zool. Jahr. Jena.* 1910, p 131; Sclater, *List. Sn. Ind. Mus.* 1891, p 54; Wall and Evans, *Bomb. N. H. J. Vol XIII*, pp 348 and 616; Wall, *Bomb. N. H. J. Vol XIX*, p 831; l. c. *Vol XXI*, p 1017.  
*Length.*—972 mm. (3 feet, 2 $\frac{1}{4}$  inches). (Captain Frere in a private letter, dated July 1911. Locality, Minbu. Burma.)  
*Distn.*—Peninsular India. North-East litoral, North of the Godavery River. Anakapalle, Vizagapatam. (Russell.) Orissa. Berhampore. (F. W.) Puri. Kendrapara. (Ind. Mus.) Bengal. Manbhum, Calcutta, and Sunderbunds. (Ind. Mus.) Burdwan. (D'Abreu in private letter.) Behar. Darbhanga. Siripur. (Ind. Mus.). Gonda, Oudh. (Bombay colln.) Patna. (D'Abreu in private letter.) Jalpaiguri. (F. W.) Assam. Goalpara and Cachar. (Ind. Mus.) Dibrugarh. (F. W.) Burma. From Mandalay (Ind. Mus.) in the North, to Tavoy (Ind. Mus.) in the South. Siam. Bangkok. (Bombay colln.) Patani. Cochín-China. China. Southern Provinces and Coastal Islands. Malay Peninsula. Kedah. Penang. Singapore. Malay Archipelago Borneo.  
*Note.*—Both Flower and Boulenger mention Ceylon within its habitat but I can find no authority for this. Possibly it has been confused with *Helicops schistosus*, a mistake I have discovered in examining various collections.
216. (468) **Hypsirhina blanfordi** Boulenger. *Blanford's Water Snake*.  
*Boulenger, Cat. Vol III*, 1896, p 10; Sclater, *List. Sn. Ind. Mus.* 1891, p 55.  
*Type.*—In the Indian Museum. Locality dubious.  
*Lepid.*—Ventrals. 122 to 125. Subcaudals. 33 to 45.  
*Distn.*—Burma. Pegu. (Blanford.) Bassein? (Sclater.)
217. (469) **Hypsirhina sieboldi** (Schlegel.) *Siebold's Water Snake*.  
*"New Homalopsid."* Dreckman, *Bomb. N. H. J. Vol I*, p 24.  
*Ferania sieboldi*. Murray, *Bomb. N. H. J. Vol I*, p 219.  
*Hypsirhina sieboldi*. Boulenger, *Cat. Vol III*, 1896, p 11; Sarasin, *Zool. Jahr. Jena.* 1910, p 144; Wall, *Bomb. N. H. J. Vol XI*, p 732; l. c. *Vol XVIII*, pp 118 and 920.  
*Length.*—775 mm. (2 feet, 6 $\frac{1}{2}$  inches).



*Lepid.*—Costals. In 27 to 33 rows. Ventrals. 143 to 158. Subcaudals. 43 to 56.

*Distn.*—*Peninsular India. Malabar Coast. Travancore. (F. W.) Bombay. (Brit. Mus.) Ganges River System. Delhi. (F. W.) Agra. (Ind. Mus.). Saugor. (Bombay colln.) Fyzabad. (F. W.) Champaran. (F. W.) Patna. (D'Abreu in private letter.) Monghyr. Purneah. (Ind. Mus.) Pusa. (Bombay colln.). Brahmaputra River. Samaguting. (Ind. Mus.) Mymensingh. (Bombay colln.). Rangoon River. Pegu. (Ind. Mus.)*

*Note.*—I discredit Penang on Cantor's authority for reasons cited in the note to *Typhlops bothriorhynchus*.

Genus.—*HOMALOPSIS* Kuhl.

218. (464) **Homalopsis buccata** (Linné.) *Linné's Water Snake.*

*Boulenger, Cat. Vol III, 1896, p 14; Sclater, List Sn. Ind. Mus. 1891, p 53.*

*Wall and Evans, Bomb. N. H. J. Vol XIII, pp 349 and 616;*

*Wall, Bomb. N. H. J. Vol XVI, p 388.*

*Length.*—1,310 mm. (4 feet, 3½ inches).

*Lepid.*—Ventrals. 157 to 173. Subcaudals. 65 to 106.

*Distn.*—*Burma. Lower reaches of the Bassein, Rangoon and Moulmein Rivers, and adjacent tanks. Siam. Indo-China. Malay Peninsula. Malay Archipelago. Sumatra. Java. Borneo.*

Genus.—*HURRIA* Daudin.

1799 Hydrus. *Schneider, part. Hist. Amph. I, p 246 [type. H. platurus (Linné)].*

1801 Elaps. *Schneider, part. Hist. Amph. II, p 301 [type E. marcgravi (Wied)].*

1803 Hurria. *Daudin, Hist. Nat. Rept. V, p 281 [type H. bilineata = H. rhynchops (Schneider)].*

1803 Coluber. (*non Linné, 1766.*) *Daudin, Hist. Nat. Rept. VII, p 167.*

1820 Python. (*non Daudin, 1803.*) *Merrem, Tent. Syst. Amph., p 89.*

1826 Homalopsis. (*non Kuhl, 1822*) *Fitzinger, N. Class Rept., p 55.*

1829 Cerberus. *Cuvier, Regne. Anim. II, p 81 [type Coluber cerberus = H. rhynchops (Schneider)].*

219. (465) **Hurria rhynchops** (Schneider.) *The Dog-faced Water Snake.*

*Cerberus boeformis. Blyth, And. Islanders, pp 365 and 366.*

*Cerberus rhynchops. Alcock and Rogers, Proc. Roy. Soc., 1902, p 449; Annandale, J. A. S. 1905, p 176; Mem. Ind. Mus. 1915, p 170; Boulenger, Cat. Vol III, 1896, p 16; Ferguson, Bomb. N. H. J. Vol X, p 74; "Keswal," Bomb. N. H. J. Vol I, p 173; Sclater, List. Sn. Ind. Mus. 1891, p 54; Sarasin, Zool. Jahr. Jena. 1910, p 131; Wall and Evans, Bomb. N. H. J. Vol XIII, pp. 345 and 612; Wall, Bomb. N. H. J. Vol XVI, p 307; l.c. 1919, p 89.*

*Hurria rhynchops. Wall, Oph. Tap. 1921, p 257.*

*Length.*—991 mm. (3 feet, 3 inches).

*Lepid.*—Ventrals. 122 to 160.

*Distn.*—*Coasts and tidal Rivers from Bombay to Indo-China. Ceylon. Andamans. Nicobars. Malay Archipelago. Sumatra to Celebes. Philippines. Formosa.*

*Note.*—One was brought to me in Bangalore on the 22nd of July 1920 by a snakeman, who tried to convince me he had procured it locally. He eventually confessed that he had captured it on the West Coast. "Nilgiris" as the locality of a specimen in the British Museum



presented by Mr. Theobald may be similarly explained. In every case where a snake has been acquired through snakemen the fact should be recorded.

Genus—GERARDIA Gray.

220. (471) **Gerardia prevostiana** (Eydoux and Gervais.) *Gerard's Water Snake*.  
*Boulenger, Cat. Vol III, 1896, p 20; Phipson, Bomb. N. H. J. Vol IX, p 486; Wall and Evans, Bomb. N. H. J. Vol XIII, p 616; Wall, Bomb. N. H. J. Vol XVI, p 307; Oph. Tap. 1921, p 262.*  
*Lepid.*—Ventrals. 145 to 156. Subcaudals. 29 to 36.  
*Distn.*—Coasts and Rivers of India. Alibag. (Bombay colln.) Bandora. (Brit. Mus.) Cannanore. (F. W.) Burma. Rangoon. (F. W.) Pegu. (Brit. Mus.) Amherst. (Ind. Mus.) Ceylon. Kelani River.  
*Note.*—The Ceylon record, though disputed, is on the authority of Ferguson, a thoroughly reliable observer. Further I found a specimen labelled Kelani River in the Colombo Museum obviously the one referred to by that authority.

Genus.—FORDONIA Gray.

221. (470) **Fordonia leucobalia** (Schlegel.) *Fordon's Water Snake*.  
*Annandale, J. A. S., Beng., 1905, p 176; Boulenger, Cat. Vol III, 1896, p 21; Sclater, List. Sn. Ind. Mus. 1891, p 55; Wall and Evans, Bomb. N. H. J. Vol XIII, p 347.*  
*Distn.*—Rivers and Coasts from the Sunderbunds to Cochin-China. Bengal. Sunderbunds. (Ind. Mus.) Burma. Rangoon. (Theobald.) Watya. (Wall and Evans.) Moulmein. (Bombay colln.) Nicobars, Cochin-China. Malay Peninsula. Singapore. Penang. Malay Archipelago. Java. Borneo. Ceram. New Guinea. North Australia.

Genus.—CANTORIA Girard.

222. (472) **Cantoria violacea** Girard. *Cantor's Water Snake*.  
*Boulenger, Cat. Vol III, 1896, p 23; Sclater, List. Sn. Ind. Mus. 1891, p 55; Wall and Evans, Bomb. N. H. J. Vol XIII, p 611; Wall, Bomb. N. H. J. Vol XXIII, p 126.*  
*Length.*—1,220 mm. (4 feet).  
*Lepid.*—Ventrals. 241 to 284. Subcaudals. 52 to 69.  
*Distn.*—Rivers of Burma. Irrawadi. (Wakema.) Moulmein. Amherst. Andamans (F. W.) Malay Peninsula. Singapore. Malay Archipelago. Borneo.

Genus.—HIPISTES Gray.

223. (473) **Hipistes hydrinus** (Cantor.) *Gray's Water Snake*.  
*Boulenger, Cat. Vol III, 1896, p 24; Sclater, List. Sn. Ind. Mus. 1891, p 56; Wall and Evans, Bomb. N. H. J. Vol XIII, pp 347 and 616.*  
*Lepid.*—Ventrals. 153 to 172. Subcaudals. 21 to 35.  
*Distn.*—Coasts and tidal rivers of Burma. Rangoon River. (Watya. Rangoon. Pegu.) Thaton. Moulmein. Amherst. Mergui. Malay Peninsula. Selangor. Penang. Kodah. Singapore. Siam. Bangkok.

Genus.—TARBOPHIS Fleischmann.

224. (NII) **Tarlophis rhinopoma** (Blanford.) *Blanford's Cat Snake*.  
*Dipsas rhinopoma. Blanford, Ann. and Mag. N. H. (4) XIV. 1874, p 34; Sclater, List. Sn. Ind. Mus. 1891, p 48.*  
*Dipsadomorphus jollyi. Wall, Bomb. N. H. J. Vol XXIII, p 167.*

*Tarbophis rhinopoma*. Boulenger, *Bomb. N. H. J. Vol IX*, p 325 ;  
*Cat. Vol III*, 1896, p 50.

*Type*.—From Karman. In the Indian Museum.

*Lepid.*—Costals. In 21 to 25 rows to behind midbody, reducing to 17 before the vent. Ventrals. 247 to 280. Anal. Entire. Subcaudals. 76 to 99.

*Distn.*—*Sind. Baluchistan*. Kacha Thana. Miranshah, Tochi Valley. *Persia*.

DIPSADOMORPHUS *Fitzinger*.

1827 *Dipsas*. (non *Laurenti*, 1768.) *Boie, part Isis*, p 548.

1843 *Dipsadomorphus*. *Fitzinger, Syst. Rept.*, p 27 [*type D trigonatus* (*Schneider*)].

225. (448) ***Dipsadomorphus multimaculatus*** (Boie.) *The Argus Cat Snake*.

*Dipsas multimaculatus*. Boulenger, *Faun. Brit. Ind. Rept.*, 1890, p 360 ; *Sclater, List. Sn. Ind. Mus.*, 1891, p 46.

*Dipsadomorphus multimaculatus*. Annandale, *J. A. S., Beng.*, 1904, p 210 ; Boulenger, *Cat. Vol III*, 1896, p 63 ; Wall and Evans, *Bomb. N. H. J. Vol XIII*, pp 346 and 615 ; Wall, *Bomb. N. H. J. Vol XIII*, p 534 ; l. c. *Vol XXV*, p 525.

*Length*.—997 mm. (3 feet, 3¼ inches).

*Lepid.*—Costals. In 19 rows to behind midbody, 15 two heads-lengths before the vent. Ventrals. 202 to 245. Subcaudals. 80 to 111.

*Distn.*—*Eastern Bengal*. Chittagong. (F. W.) *Burma*. As far North as Mandalay. (Bombay colln.), and South to Moulmein. *Shan States*. *Siam*. Pachebon. Pitsanuloke. Sanam Cheng. Bangkok. *Indo-China*. *China*. Southern Provinces and Coastal Islands. Fumun. Canton. Hongkong. *Malay Peninsula* ? Penang. (Cantor.) *Malay Archipelago*. Sumatra. Java. Celebes.

*Note*.—I attach a query to the Malay Peninsula for reasons cited in the note to *Natrix parallelus*. Cantor appears to be the only authority for this locality.

226. (445) ***Dipsadomorphus barnesi*** (Günther.) *Barnes's Cat Snake*.

*Dipsas barnesi*. Abercromby, *Sn. of Ceylon*, 1910, pp 47 and 78 ; *Spol. Zeylan*. 1911, p 206 ; Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 359 ; Willey, *Spol. Zeylan*. 1903, p 81 ; l. c. 1906, p 233.

*Dipsadomorphus barnesi*. Boulenger, *Cat. Vol III*, 1896, p 73 ; Sarasin, *Zool. Jahr. Jena*. 1910, p 127 ; Wall, *Oph. Tap.* 1921, p 283.

*Lepid.*—Costals. In 19 rows to behind midbody, reducing to 15 two heads-lengths before the vent. Ventrals. 208 to 220. Subcaudals. 99.

*Distn.*—*Ceylon*. Gangaruwa.

*Note*.—I have examined the type, and the only other known specimen in the Colombo Museum.

227. (Nil.) ***Dipsadomorphus quincunciatus*** Wall. *Wall's Cat Snake*.

Wall, *Bomb. N. H. J. Vol XVIII*, p 272 ; l. c. *Vol XIX*, p 833.

*Type*.—In the British Museum from Tinsukia near Dibrugarh, Assam.

*Length*.—1,055 mm. (3 feet, 5½ inches).

*Lepid.*—Costals. In 19 rows to behind midbody, 15 two heads-lengths before the vent. Ventrals. 237 to 242. Anal. Divided. Subcaudals. 118.



*Distn.*—Assam. Tinsukia and Rangagara, both near Dibrugarh.

*Notes.*—I have seen two examples the only ones known.

228. (446) **Dipsadomorphus ceylonensis** Günther. *Günther's Cat Snake.*

*Dipsas ceylonensis.* Abercromby, *Sn. of Ceylon*, 1901, pp 49 and 77; *Spol. Zeylan.* 1911, pp 205 and 207; *Ferguson, Bomb. N. H. J. Vol X*, p 73; *Pearless, Spol. Zeylan.* 1909, p 54; *Willey, Spol. Zeylan.* 1903, p 82.

*Dipsadomorphus ceylonensis.* *Boulenger, Cat. Vol III*, 1896, p 66 (part.); *Wall, Rec. Ind. Mus.* 1909, p 152; *Bomb. N. H. J. Vol XXVI*, p 570; *Oph. Tap.* 1921, p 278.

*Length.*—1,283 mm. (4 feet, 2½ inches).

*Lepid.*—Costals. In 19 rows to behind midbody, 13 or 15 two heads-lengths before vent. Ventrals. 214 to 235. Subcaudals. 91 to 111.

*Distn.*—*Western Ghats.* From Matheran to Travancore. *Ceylon.* Hills of Central and Sabaragamuwa Provinces.

*Note.*—Has been confused with *beddomei*, *nuchalis*, and *andamanensis*. I have examined 82 examples. Annandale (*Rec. Ind. Mus.* 1909, p 281) contests my view that these four “forms” are entitled to rank as species, and I expect many others to accept his view in opposition to mine, which I adhere to. In the circumstances it is open to those who agree with Annandale to relegate *beddomei*, *nuchalis*, and *andamanensis* to the rank of varieties of *ceylonensis*.

229. (446) **Dipsadomorphus beddomei** Wall. *Beddome's Cat Snake.*

*Dipsas ceylonensis.* Abercromby, *Spol. Zeylan.* 1911, pp 205 and 207, *Boulenger, Faun. Brit. Ind. Rept.* 1890; p 359 (part); *Ferguson, Bomb. N. H. J. Vol X*, 1895, p 73; *Willey, Spol. Zeylan.* 1903 p 82.

*Dipsadomorphus ceylonensis.* *Boulenger, Cat. Vol III*, 1896, p 66 (part); *Wall, Rec. Ind. Mus.* 1909, p 152.

*Dipsadomorphus beddomei.* *Wall, Spol. Zeylan.* 1921, p 406; *Oph. Tap.* 1921, p 282.

*Length.*—1,232 mm. (4 feet and ½ an inch).

*Lepid.*—Costals. In 19 rows to behind midbody, 15 or 13 two heads-lengths before the vent. Ventrals. 248 to 266. Subcaudals. 111 to 129.

*Distn.*—*Western Ghats.* Matheran to Travancore. *Ganjam Dist.* (Berhampore close to Hills.) *Ceylon.* C. Prov. (Kandy. Peradeniya.) N. Prov. (Mullaitivu).

*Note.*—I have examined 13 specimens.

230. (449) **Dipsadomorphus hexagonotus** (Stoliczka) (non Blyth) *The Tawny Cat Snake.*

*Dipsas hexagonotus.* *Anderson, P. Z. S.* 1871, p 185 (part); *Boulenger, Faun. Ind. Rept.* 1890, p 361 (part); *Stoliczka, J. A. S., Beng.*, 1870, p 198 (part); *Wall and Evans, Bomb. N. H. J. Vol XIII*, pp 346 and 615.

*Dipsadomorphus hexagonotus.* *Boulenger, Cat. Vol III*, 1896, p 65 (part); *Venning, Bomb. N. H. J. Vol XX*, p 342; *Wall, Rec. Ind. Mus.* 1909, p 154.

*Length.*—1,016 mm. (3 feet, 4 inches).

*Lepid.*—Costals. In 19 rows to behind midbody, 15 two heads-lengths before vent. Ventrals. 221 to 246. Subcaudals. 89 to 107.

*Distn.*—*Burma.* From Bhamo in the North to Tenasserim (Kawkarait) in the South. Chin Hills. (Haka.) S. Shan States. (Taunggyi.) *Andamans.*



*Note*.—This is not the snake described by Blyth as *hexagonotus*. (J. A. S., Beng., 1856, p 360.) His type specimen (No 8048 in the Indian Museum) is a young *D. cyaneus* (Dumeril and Bibron). It is probable that the specimens reported from Siam, Cochin-China and the Andamans are *hexagonotus*, but precise details regarding the lepidosis are wanting. I have examined 22 examples.

231. (444) **Dipsadomorphus trigonatus** (Schneider.) *The Common Cat Snake or Gamma Snake.*

*Dipsas gokool*. Phipson, *Bomb. N. H. J. Vol II*, p 247; Traill, *Bomb. N. H. J. Vol IX*, p 499.

*Dipsas trigonatus*. Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 360; Ferguson, *Bomb. N. H. J. Vol X*, p 73; Sclater, *List. Sn. Ind. Mus.* 1891, p 45; Wall, *Bomb. N. H. J. Vol XVI*, p 307.

*Dipsadomorphus trigonatus*. Annandale, *J. A. S., Beng.*, 1904, p 209; Boulenger, *Cat Vol III*, 1896, p 63; Mullan, *Bomb. N. H. J. Vol XVIII*, p 919; Nurse, *Bomb. N. H. J. Vol XIII*, p 340; Sarasin, *Zool. Jahr. Jena*, 1910, p 144; Wall, *Bomb. N. H. J. Vol XV*, p 524; *l. c. Vol XVIII*, pp 120 and 543; *l. c. Vol XIX*, pp 267a and 352; *l. c. Vol XX*, pp 864 and 1038; *l. c. Vol XXVI*, p 569; *Oph. Tap.* 1921, p 269.

*Length*.—940 mm. (3 feet, 1 inch).

*Lepid*.—Costals. 21 to behind midbody, 15 two heads-lengths before vent. Ventrals. 206 to 256. Subcaudals. 75 to 96.

*Distn*.—*Peninsular India*. To the Himalayas. *Punjab. Sind. Baluchistan. Transcaspia. N. W. Frontier. Western Himalayas. Subathu. (Ind. Mus.) Almora. (F. W.) Eastern Himalayas. Sikkim. (F. W.) Bengal. As far East as Calcutta. Ceylon. Uva Prov. (Haldamulle. F. W.)*

*Note*.—The snakes referred to by Anderson (*J. A. S., Beng.*, Vol XL, p 35) from Assam and Naga Hills are probably *D. gokool*, a species with which *D. trigonatus* was frequently confused by early herpetologists.

232. (447) **Dipsadomorphus gokool** (Gray.) *Gray's Cat Snake.*

*Dipsas gokool*. Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 360; Sclater, *List. Sn. Ind. Mus.* 1891, p 46.

*Dipsadomorphus gokool*. Annandale, *Rec. Ind. Mus.* 1912, pp 37 and 49; Boulenger, *Cat. Vol III*, 1896, p 64; Wall, *Bomb. N. H. J. Vol XIX*, p 831.

*Length*.—870 mm. (2 feet, 10¼ inches).

*Lepid*.—Costals. 21 to behind midbody, 17 or 15 two heads-lengths before the vent. Ventrals. 224 to 232. Subcaudals. 87 to 101.

*Distn*.—*Bengal. Jessore. Jalpaiguri. (Ind. Mus.) Darjeeling Dist. (F. W.). Assam. Sadiya. Sonapur. Sibsagar. (Ind. Mus.) Dibrugarh. Dejoo. (F. W.) Cachar (Monacherra. Bombay colln.) Garo Hills. (Tura. Bombay colln.) Khasi Hills. (Shillong. F. W.) Naga Hills. (Samaguting. Ind. Mus.). Burma. Manipur (F. W.).*

*Note*.—Malay Peninsula I discredit for reasons cited in the note to *Typhlops bothriorhynchus*.

233. (Nil.) **Dipsadomorphus multifasciatus** Blyth. *The Himalayan Cat Snake.*

*Dipsas multifasciatus*. Sclater, *List. Sn. Ind. Mus.* 1891, p 46.

*Dipsadomorphus multifasciatus*. Boulenger, *Cat. Vol III*, 1896, p 69; Wall, *Rec. Ind. Mus.* 1907, p 157; *Bomb. N. H. J. Vol XIX*, p 352; *l. c. Vol XXVI*, p 866.

*Length*.—1,157 mm. (3 feet, 9½ inches).

*Lepid.*—Costals. In 21 rows to behind midbody, 15 two heads-lengths before the vent. Ventrals. 223 to 251. Subcaudals. 96 to 116.

*Distn.*—*Himalayas*. W. *Himalayas*. Subathu. Mussooree. Naini Tal. (Ind. Mus.) Naini Tal. Muktesar. (F. W.) E. *Himalayas*. Nepal. (Chitlong. Ind. Mus.) Darjeeling Dist. (Ind. Mus.) Pashok. Tindharia. Mungpoo. (F. W.)

*Note*.—I have seen over 20 specimens, and though uncommon, it appears to be about as numerous in the Western Himalayas as in the Eastern part of that Range, up to 7,000 feet.

234. (449) **Dipsadomorphus stoliczkæ** Wall. *Stoliczka's Cat Snake*.

*Dipsas hexagonotus*. Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 65 (part); Sclater, *List. Sn. Ind. Mus.* 1891, p 47 (part, No 7932).

*Dipsadomorphus hexagonotus*. Annandale, *Rec. Ind. Mus.* 1909, p 281; Boulenger, *Cat. Vol III*, 1896, p 65 (part); *Rec. Ind. Mus.* 1913, p 338; Wall, *Bomb. N. H. J. Vol XIX*, pp 352 and 758; *Rec. Ind. Mus.* 1909, p 154.

*Dipsadomorphus stoliczkæ*. Wall, *Rec. Ind. Mus.* 1909, p 155.

*Length*.—1,105 mm. (3 feet, 7½ inches).

*Lepid.*—Costals. In 21 rows to behind midbody, 15 two heads-lengths before the vent. Ventrals. 223 to 252. Subcaudals. 100 to 119.

*Distn.*—*Eastern Himalayas*. Buxa Doars to Sikkim. Assam. Goalpara. Sibsagar. Cachar. (Ind. Mus.)

*Note*.—Has been confused with *D. hexagonotus* Stoliczka, so I give only localities I can guarantee. I have examined in all 74 examples. It is to be noted that two specimens in the British Museum from Burma conform to this type, but their donor Colonel Beddome has been shown unreliable in many of his records. See note to *Natrix parallelus*.

Annandale (*Rec. Ind. Mus.* 1909, p 281) contests my view that this deserves specific rank apart from *hexagonotus*. To those who share his view this "form" should be considered a "variety" of *hexagonotus*.

235. (446) **Dipsadomorphus nuchalis** (Günther.) *The Collared Cat Snake*.

*Dipsas ceylonensis*. Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 66 (part); Sclater, *List. Sn. Ind. Mus.* 1890, p 46 (part except No 7932).

*Dipsadomorphus ceylonensis*. Boulenger, *Cat. Vol III*, 1896, p 66 (part).

*Dipsadomorphus nuchalis*. Wall, *Rec. Ind. Mus. Vol XIX*, p 153; l. c. *Vol. XXI*, p 279; *Bomb. N. H. J. Vol XXVI*, p 571.

*Length*.—1,309 mm. (4 feet, 3½ inches).

*Lepid.*—Costals. In 21 rows to behind midbody, 15 two heads-lengths before vent. Ventrals. 234 to 251. Subcaudals. 90 to 108.

*Distn.*—*Western Ghats*. South of the Goa gap. Wynad to Travancore. Shevaroyes. *Eastern Himalayas*. Nepal (Chitlong). Assam. Sibsagar. N. Cachar. (Ind. Mus.)

*Note*.—I have seen 60 examples. I have two skulls, the teeth of which number. Maxillary, 14 praecranterian, 2 cranterian. Palatine, 6 to 7. Pterygoid, 15 to 17. Mandibular, 20 to 23.

236. (Nil.) **Dipsadomorphus dightoni** (Boulenger.) *Dighton's Cat Snake*.

*Dipsas dightoni*. Boulenger, *Bomb. N. H. J. Vol VIII*, p 528; Ferguson, *Bomb. N. H. J. Vol X*, p 73.



*Dipsadomorphus dightoni*. Annandale, *J. A. S., Beng.*, 1904, p 210 ;  
Boulenger, *Cat. Vol III*, 1896, p 69 ; Sarasin, *Zool. Jahr. Jena*. 1910  
p 136.

*Lepid.*—Costals. In 23 rows to behind midbody, 17 or 15 two heads-  
lengths before the vent. Ventrals. 228 to 241. Subcaudals. 95 to 102.

*Distn.*—*Western Ghats*. Travancore. [Pirmed. Brit. Mus. Ind. Mus.  
(No 13787). ]

*Note.*—I have examined three specimens, the only ones known, all from  
Pirmed.

BOIGA Fitzinger.

1803 Hurria. Daudin, *part*, *Bull. Soc. Philom. Paris. III*, No 72, p 187  
[*type Hurria rynchops* (Schneider) ].

1826 Boiga. Fitzinger, *part*, *Neue. Class Rept.* p 29 [*type Coluber irregularis*  
=*Boiga irregularis* (Merrem) ].

1827 Dipsas. (non Laurenti, 1768.) Boie, *part*, *Isis.*, p 548.

1843 ? Macrocephalus. Fitzinger, *Syst. Rept.* p. 27 [*type Dipsas drapiezii*=  
*Boiga ? drapiezi* (Boie) ].

1843 Gonyodipsas. Fitzinger, *Syst. Rept.* p 27 [*type Dipsas irregularis*=*Boiga*  
*irregularis* (Merrem) ].

1843 Eudipsas. Fitzinger, *Syst. Rept.* p 27 [*type Dipsas cynodon*=*Boiga*  
*cynodon* (Boie) ].

1843 ? Cephalophis. Fitzinger, *Syst. Rept.* p 27 [*type Dipsas dendrophila*=  
*Boiga dendrophila* (Boie) ].

1853 Opetiodon. Dumeril, *Prodr. Class. Ophid.* p 98 [*type O. cynodon*=  
*Boiga cynodon* (Boie) ].

1853 Triglyphodon. Dumeril, *Prodr. Class. Ophid.*, p 111 [*type T. irregulare*=  
*Boiga irregularis* (Merrem) ].

1857 ? Toxicodryas. Hallowell, *Proc. Philad. Acad.* p 60 (*type T. blandingi*).

1877 Pappophis. Macleay, *Proc. Linn. Soc. N. S. Wales, II*, p 39 [*type P*  
*laticeps*=*Boiga irregularis* (Merrem) ].

1895 ? Liophallus. Cope, *Proc. Philad. Acad.* p 427 [*type Dipsas fusca*=*Boiga?*  
*fusca* (Gray) ].

237. (446) **Boiga andamanensis** (Wall.) *The Andaman Cat Snake.*

*Dipsas ceylonensis*. Stoliczka, *J. A. S., Beng.*, 1870, p 198 (*part*).

*Dipsas fusca*. Slater, *List. Sn. Ind. Mus.* 1891, p 47 (*part*, Nos 7928,  
7929, 7930 and 8641).

*Dipsadomorphus ceylonensis*. Annandale, *J. A. S., Beng.*, 1905, p 174  
(*part*): Stoliczka, *J. A. S., Beng.*, 1856, p 360 (*part*).

*Dipsadomorphus andamanensis*. Wall, *Rec. Ind. Mus.* 1909, p 153.  
*Types.*—In the Indian Museum from the Andamans.

*Length.*—1,486 mm. (4 feet, 10½ inches).

*Lepid.*—Costals, 21 to behind midbody, 15 two heads-lengths before  
the vent. Ventrals. 259 to 269. Subcaudals. 118 to 133.

*Distn.*—*Andaman Islands*.

*Note.*—I have seen 9 examples. I have one skull, the teeth of which  
number. Maxillary. 13 praecranterian, 3 cranterian. Palatine 7 to  
8, Pterygoid 20. Mandibular 21 to 22.

238. (450) **Boiga cyanea** (Dumeril and Bibron.) *The Green Cat Snake.*

*Dipsas hexagonotus*. Blyth, *J. A. S., Beng.*, 1856, p 360 ; Stoliczka,  
*J. A. S., Beng.*, Vol XXXIX, p 198 (*part*).

*Dipsas fusca*. Slater, *List. Sn. Ind. Mus.* 1891, p 47 (*part*, No 8048).

*Dipsas cyaneus*. Boulenger, *Faun. Brit. Ind. Rept.* 1890, p 361 ; Evans,  
*Bomb. N. H. J. Vol XIII*, p 553 ; Slater, *List. Sn. Ind. Mus.* 1891,  
p 47 ; Wall and Evans, *Bomb. N. H. J. Vol XIII*, pp 188 and 346.



*Dipsadomorphus ceylonensis*. Annandale, J. A. S., Beng., 1905, p 174 (part); Sarasin, Zool. Jahr. Jena. 1910, p 134 (part).

*Dipsadomorphus cyaneus*. Boulenger, Cat. Vol III, 1896, p 72; Evans, Bomb. N. H. J. Vol XVI, p 170; Wall, Bomb. N. H. J. Vol XVIII, p 329; l. c. Vol XIX, p 353; Rec. Ind. Mus. 1909, p 154.

*Length*.—1,448 mm. (4 feet, 9 inches).

*Lepid.*—Costals. 21 to behind midbody, 15 two heads-lengths before the vent. In some specimens the vertebral row divides as in other species of this genus, making the scale rows appear 23 in places. Ventrals. 237 to 257. Subcaudals. 124 to 134.

*Distn.*—*Eastern Himalayas*. Darjeeling. (Brit. Mus.) Tindharia. (F. W.) Assam. Cachar. (Ind. Mus.) Sonapur. Monacherra. (Bombay colln.). Khasi Hills. (Cherrapunji. Ind. Mus. Nongpho F. W.) *Burma*. Kokine, near Rangoon. (Evans) Insein near Rangoon. (Wall and Evans) Tavoy. (Ind. Mus.) *Siam*. Klong Menao. East of Sriracha. Koh Phai Island (Malcolm-Smith) *Indo-China*. (Mocquard.)

239. (Nil.) **Boiga cynodon** (Boie.) Boie's Cat Snake.

*Dipsas cyanea*. Wall and Evans, Bomb. N. H. J. Vol XIII, p 615.

*Dipsas cynodon*. Slater, List. Sn. Ind. Mus. 1891, p 47.

*Dipsadomorphus cynodon*. Boulenger, Cat. Vol III, 1896, pp 78 and 164; Wall, Bomb. N. H. J. Vol XIX, p 353; l. c. Vol XIX, pp 832 and 899.

*Lepid.*—Costals. In 23 or 25 rows to behind midbody, 15 two heads-lengths before the vent. Ventrals (for Indian specimens). 249 to 277. Subcaudals (for Indian specimens). 114 to 147.

*Distn.*—*Eastern Himalayas*. Jalpaiguri. Tindharia. (F. W.) Assam. (Dibrugarh. F. W.) Cachar. (Ind. Mus.) Garo Hills. (Ind. Mus.) Naga Hills. (Samaguting. Ind. Mus.) *Burma*. Thavetmyo. (Ind. Mus.) Toungoo. (Brit. Mus.) Rangoon. Myitkyina. (F. W.) Mergui. (Ind. Mus.) Burma-Siam Hills. (Ind. Mus.) *Siam*. Bangnara, Patani State. (M. Smith). *Malay Peninsula*. (Brit. and Ind. Mus.) *Malay Archipelago*. Borneo. (Brit. Mus.) *Philippines*. (Brit. Mus.)

240. (451) **Boiga forsteni** (Dumeril and Bibron.) Forsten's Cat Snake.

*Dipsas forsteni*. Abercromby, Sn. of Ceylon. 1910, pp 47 and 78; Spol. Zeylan. 1911, p 206; l. c. 1913, p 145; Alcock and Rogers, Proc. Roy. Soc. 1902, p 449; Boulenger, Faun. Brit. Ind. Rept. 1890, p 362; Ferguson, Bomb. N. H. J. Vol X, p 73; Pearless, Spol. Zeylan. 1909, p 54; Slater, List. Sn. Ind. Mus. 1891, p 47; Willey, Spol. Zeylan. 1903, p 82; l. c. 1906, p 233.

*Dipsadomorphus forsteni*. Boulenger, Cat. Vol III, 1896, p 80; Sarasin, Zool. Jahr. Jena. 1910, p 130; Wall, Bomb. N. H. J. Vol XIX, p 757; l. c. Vol XXVI, p 571; Spol. Zeylan. 1921, p 406.

*Boiga forsteni*. Wall, Oph. Tap. 1921, p 285.

*Length*.—2,313 mm. (7 feet, 7 inches).

*Lepid.*—Costals. In from 25 to 31 rows to behind midbody, 17 or 15 before the vent. Ventrals. 254 to 273. Subcaudals. 102 to 119 (131 Boulenger).

*Distn.*—*Ceylon*. Peninsular India. Western Ghats. Matheran to Travancore. Ganges Valley. Orcha. Fyzabad. Gorakhpur. (Bombay colln.) Balrampur. (F. W.) Purnea. Manbhum (Ind. Mus.). Orissa. Berhampore. (F. W.) Bengal. Sijna (F. W.). *Western Himalayas*. Naini Tal Dist. (Kaladungi. F. W.) *Eastern Himalayas*. Darjeeling Dist. (F. W.).

Genus.—TAPHROMETAPON Brandt.

241. (Nil.) **Taphrometapon lineolatum** Brandt. *Brandt's Sand Snake.*

*Psammophis leithi.* Sclater, *List. Sn. Ind. Mus.* 1891, p 50 (part, No 11697).

*Psammophis schokari.* Wall, *Bomb. N. H. J. Vol XX*, p 1039 (part).

*Psammophis triticeus.* Wall, *Bomb. N. H. J. Vol. XXI*, p 634.

*Taphrometapon lineolatum.* Alcock and Finn, *J. A. S., Beng.*, 1896, p 563; Annandale, *J. A. S., Beng.*, 1904, p 210; Boulenger, *Cat. Vol III*, 1896, p 151; Sclater, *List. Sn. Ind. Mus.* 1891 p 49.

*Length.*—870 mm. (2 feet, 10 $\frac{1}{4}$  inches).

*Lepid.*—Costals. In 17 rows to behind midbody, 13 two heads-lengths before the vent. Ventrals. 174 to 197. Anal. Divided. Subcaudals. 72 to 107.

*Distn.*—*Baluchistan.* Quetta. Marachak. Chaman. Baleli. *Afghanistan.* *Persia.* *Turkestan.* *Aralo-Caspian Steppes.*

Genus.—PSAMMOPHIS Boie.

242. (454) **Psammophis leithi** Günther. *Leith's Sand Snake.*

*P. leithi.* Boulenger, *Cat. Vol III*, 1896, p 155; Sclater, *List. Sn. Ind. Mus.* 1891, p 50 (part, Nos 7596, 8663, 8705 and 11453); Wall, *Bomb. N. H. J. Vol XVIII*, pp 120 and 203; l. c. *Vol XX*, p 1039.

*Lepid.*—Ventrals. 161 to 185. Subcaudals. 85 to 107.

*Distn.*—*Ganges Valley.* Fyzabad. Rae Bareli. (F. W.) Gwalior. (Brit. Mus.) Banda. N. W. P. (Ind. Mus.) *Cutch.* (Ind. Mus.) *Rajputana.* Ajmer. (Brit. Mus.) *Punjab.* Campbellpore. (Bombay colln.) *Sind.* Karachi. (Ind. Mus.) *Baluchistan.* Munro Khalat. (Brit. Mus.) Duki. (Quetta Mus.) *N. W. Frontier.* Thal. (F. W.)

*Note.*—A specimen in the Bombay collection (No 652) is labelled "Cannanore. Donor Major F. Wall." This is a mistake as I never obtained it from that locality. It is necessary to remark upon this to show that the records of this collection are not completely reliable, in spite of every care. (See note to *Silybura phipsoni.*)

243. (Nil.) **Psammophis schokari** (Forskal.) *Schokar's Sand Snake.*

*P. leithi.* Sclater, *List. Sn. Ind. Mus.* 1891, p 50 (part, Nos 4612, 4613, 4614, 7602, 7603, 8440, 8584, 8585, 8593, 10974, 11421, 13421, 13422.)

*P. schokari.* Boulenger, *Cat. Vol III*, 1896, p 157; *P. Z. S.* 1919, pp 290 and 305; Wall, *Bomb. N. H. J. Vol XVIII*, p 803; l. c. *Vol XX*, p 1039.

*Lepid.*—Ventrals. 174 to 186. (Boulenger, 162 to 195.) Subcaudals. 112 to 137. (Boulenger, 93 to 149).

*Distn.*—*Punjab.* Lahore. (F. W.) *Sind.* Karachi. Sukkur. *Baluchistan.* *Afghanistan.* *Persia.* *Syria.* *Arabia.* *Somaliland.* *N. Africa.* *Sahara.*

244. (456) **Psammophis longifrons** Boulenger. *Boulenger's Sand Snake.*

*P. longifrons.* Boulenger, *Cat. Vol III*, 1896, p 165; D'Abreu, *Bomb. N. H. J. Vol XXII*, p 634; Dreckman, *Bomb. N. H. J. Vol VII*, p 406; Gleadow, *Bomb. N. H. J. Vol VIII*, p 553.

*Lepid.*—Ventrals. 166 to 175.

*Distn.*—*Peninsular India.* Cuddapah Hills? Bombay Dist. (Godra. Thana. Kalyan. Bulsar. Bombay colln.) Central Provinces (Nagpur).

*Note.*—I attach a query to Cuddapah Hills as this locality rests upon the sole authority of Beddome. (See note to *Natrix parallelus.*)



245. (455) **Psammophis condanarus** (Merrem.) *Merrem's Sand Snake*.

*P. condanarus*. *Boulenger, Cat. Vol III, 1896, p 165*; *Sclater, List. Sn. Ind. Mus. 1891, p 50 (part, all except No 8730)*; *Wall and Evans, Bomb. N. H. J. Vol XIII, p 617*; *Wall, Bomb. N. H. J. Vol XVIII, p 121*; *l. c. Vol XX, p 626*.

*Length*.—978 mm. (3 feet, 2½ inches).

*Lepid.*—Ventrals. 156 to 188. Subcaudals. 71 to 92.

*Distn.*—*Cutch*. (Ind. Mus.) *Punjab*. Chillianwala. (Brit. Mus.) *Sind*. Kotri. (Brit. Mus.) *Western Himalayas*. Simla. (Ind. Mus.) *Mussorie*. Almora. Muktesar. (F. W.) *Ganges Valley*. Fyzabad. (F. W.) *Lower Bengal*. (Ind. Mus.) *Burma*. Pegu. (Brit. Mus.) *Prome*. Bassein. (Ind. Mus.) *Tharrawady*. (F. W.) *S. Shan States*. (Brit. Mus.) *Siam*. (Brit. Mus.)

Genus.—PSAMMODYNASTES Günther.

246. (453) **Psammodynastes pulverulentus** (Günther.) *The Mud Viper*.

*P. pulverulentus*. *Annandale, Rec. Ind. Mus. 1912, pp 37, 50 and 54*; *Boulenger, Cat. Vol III, 1896, p 172*; *Rec. Ind. Mus. 1913, p 338*; *Sclater, List. Sn. Ind. Mus. 1891, p 49*; *Venning, Bomb. N. H. J. Vol XX, p 342*; *l. c. Vol XX, pp 72 and 774*; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp 349 and 617*; *Wall, Bomb. N. H. J. Vol XVIII, pp 204 and 330*; *l. c. Vol XIX, pp 353, 758 and 833*; *l. c. Vol XX, pp 73 and 686*.

*Length*.—629 mm. (2 feet and ¾ of an inch).

*Lepid.*—Subcaudals. 44 to 71.

*Distn.*—*Eastern Himalayas*. Buxa Dooars to Sikkim. *Assam*. Hills and Plains North and South of the Bramaputra. *Burma*. From Katha (Long. 96°1', Lat. 24°1') in the North to Tenasserim. *Malay Peninsula*. *Siam*. *Indo-China*. *S. China*. *Malay Archipelago*. Sumatra to Celebes. *Philippines*. *Formosa*.

Genus.—DRYOPHIS Dolman.

247. (457) **Dryophis perroteti** (Duméril and Bibron.) *Perrotet's Whip Snake*.

*D. perroteti*. *Boulenger, Cat. Vol III, 1896, p 178*; *Sarasin, Zool. Jahr. Jena, 1910, p 138*; *Sclater, List. Sn. Ind. Mus. 1891, p 518*. *Wall, Bomb. N. H. J. Vol XVII, p 7*; *l. c. Vol XXVI, p 572*.

*Length*.—585 mm. (1 foot, 11 inches).

*Lepid.*—Subcaudals. 65 to 84.

*Distn.*—*Western Ghats*. N. Canara. Nilgiris.

248. (459) **Dryophis fronticinctus** Günther. *Günther's Whip Snake*.

*D. fronticinctus*. *Boulenger, Cat. Vol III, 1896, p 179*; *Sclater, List. Sn. Ind. Mus. 1891, p 51*; *Wall and Evans, Bomb. N. H. J. Vol XIII, p 346*; *Wall, Bomb. N. H. J. Vol XVII, p 7*; *l. c. Vol XIX, p 353*.

*Length*.—864 mm. (2 feet, 10 inches).

*Lepid.*—Ventrals. 168 to 196.

*Distn.*—*Eastern Himalayas*. Darjeeling Dist. (F. W.) *Assam*. Sibsagar. (Ind. Mus.) *Burma*. Watiya. Rangoon. (F. W.) *Pegu*. (Brit. Mus.)

*Note*.—I think the specimens from Darjeeling and Assam will prove to constitute a species distinct from *fronticinctus*. In two Burmese specimens in the Indian Museum (Nos 7791 and 7792) I find the preacranterian teeth (behind the second edentulous space) 6, and 7 (or 8) respectively. In the specimen from Dibrangach (preserved in the Bombay collection) these teeth number 3, and in a specimen from Sibsagar in the Indian Museum (No 6924) they number 4. I cannot



however discover any difference in lepidosis. It is significant that the Burmese species which Stoliczka (J.A.S., Bengal, Vol XXXIX, p 197) reports a true brackish water species common about the mouth of the Moulmein River, and Theobald (Cat. Rept. Brit. Burma, p 53) reports "by no means scarce" in the Mangrove swamps on the Arakan Coast, should not have been recorded anywhere in Burma except at the mouths of rivers, and should again be found far inland in Assam, and in the Darjeeling District.

249. (458) **Dryophis dispar** (Günther.) *Beddome's Whip Snake.*

*D. dispar.* Boulenger, *Cat. Vol III*, 1896, p 179; *Ferguson, Bomb. N. H. J. Vol X*, 1895, p 73; *Fischer, Bomb. N. H. J. Vol XXIV* p 194; *Sarasin, Zool. Jahr. Jena.* 1910, p 142; *Sclater, List. Sn. Ind. Mus.* 1891, p. 51; *Wall, Bomb. N. H. J. Vol XVII*, p 7.

*Length.*—788 mm. (2 feet, 7 inches).

*Lepid.*—Ventrals. 136 to 156. Subcaudals. 78 to 106.

*Distn.*—*Western Ghats.* Nilgiris to Travancore.

*Note.*—The snake alluded to by Mocquard (Rept. L'Indo-Chine, 1907, p 47) is obviously not this species, or if the identification is correct did not come from Indo-China.

250. (460) **Dryophis prasinus** Boie. *Boie's Whip Snake.*

*Annandale, Rec. Ind. Mus.* 1912, pp 37, 50 and 54; *Boulenger, Cat. Vol III*, 1896, p 180; *Rec. Ind. Mus.* 1913, p 338; *Evans, Bomb. N. H. J. Vol XVI*, p 169; *Wall and Evans, Bomb. N. H. J. Vol XIII*, p 616; *Sclater, List. Sn. Ind. Mus.* 1891, p 51; *Wall, Bomb. N. H. J. Vol XVII*, p 7; *l. c. Vol XIX*, pp 353, 825, 834 and 899.

*Lepid.*—Ventrals. 194 to 235. (196 to 215 for Indo-Burmese specimens). Subcaudals. 151 to 207. (155 to 182 for Indo-Burmese specimens.).

*Distn.*—*Bengal.* Jalpaiguri Dist. (F. W.) *Eastern Himalayas.* Sikkim. Bhutan. *Assam.* Plains and Hills North and South of the Bramaputra River. Chittagong Hills. *Burma.* As far North as Mansi. (Lat. 24° 7'. Long. 95° 7'.) South to Tenasserim. East to S. Shan States. *Malay Peninsula.* *Siam.* *Indo-China.* *Malay Archipelago.* Sumatra to Celebes. *Philippines.*

251. (461) **Dryophis mycterizans** (Linné.) *The Common Green Whip Snake.*

*D. pulverulentus.* *Sclater, List. Sn. Ind. Mus.* 1891, p 52 (part, Nos 7811 and 7816).

*D. mycterizans.* *Abercromby, Sn. of Ceylon*, 1910, pp 49 and 63; *Spol. Zeylan.* 1911, pp 205 and 207; *l. c.* 1913, p 144; *Alcock and Rogers, Proc. Roy. Soc.* 1902, p 450; *Annandale, Mem. A. S., Beng., Vol 10*, p 196; *Boulenger, Cat. Vol III*, 1896, p 182; *Caius, Bomb. N. H. J. Vol XXVII*, p 862; *Evans, Bomb. N. H. J. Vol XVI*, p 169; *Ferguson, Bomb. N. H. J. Vol VI*, p 420; *l. c. Vol X*, p 73; *Green, Spol. Zeylan.* 1903, p 36; *Kinlock, Bomb. N. H. J. Vol XXVI*, p. 681; *Kinnear, Bomb. N. H. J. Vol XXI*, p 1336; *Pearless, Spol. Zeylan*, 1909, p 54; *Primrose, Bomb. N. H. J. Vol XV*, p 347; *Sarasin, Zool. Jahr. Jena.* 1910, p 131; *Sclater, List. Sn. Ind. Mus.* 1891, p 52; *Wall and Evans, Bomb. N. H. J. Vol XIII*, pp 347 and 615; *Wall, Bomb. N. H. J. Vol XVI*, pp 308, 394 and 542; *l. c. Vol XVII*, p 7; *l. c. Vol XVIII*, pp 783 and 919; *l. c. Vol XIX*, p 757; *l. c. Vol XX*, pp 229 and 524; *l. c. Vol XXVI*, p 572; *Spol. Zeylan.* 1921, p 401; *Oph. Tap.* 1921, p 291; *Willey, Spol. Zeylan.* 1906, p 227.

*Length.*—1,944 mm. (6 feet, 4½ inches).

*Lepid.*—Ventrals. 168 to 206. (Peninsular India, 168 to 188. Bengal, E. Himalayas and Burma, 176 to 206.) Subcaudals. 136 to 174. (Peninsular India, 137 to 174. Bengal, E. Himalayas, and Burma. 140 to 153.)

*Distn.*—Ceylon. Peninsular India. Excluding the Ganges Valley West of Patna. Bengal. Eastern Himalayas. Assam. Burma. Siam. Indo-China.

*Note.*—I question the reliability of Mount Abu (Ind. Mus.) and Allahabad on the authority of the von Schlagintweits. These collectors are also responsible for the records of *Eryx conicus* and *Eryx johni* from Sikkim at 4,900 and 9,800 feet respectively. This is an extremely common species in the stock in trade of itinerant jugglers, and all the three species alluded to may have been derived from this source. *Vide* my note to *Hurria rynchops*.

252. (462) **Dryophis pulverulentus** (Dumeril and Bibron.) *The Brown Speckled Whip Snake.*

*D. pulverulentus.* Abercromby, *Sn. of Ceylon*, 1910 pp 49 and 79; *Spol. Zeylan.* 1913, p 144; Boulenger, *Cat. Vol III*, 1896, p 184; Ferguson, *Bomb. N. H. J. Vol. XIV*, p 386; Sarasin, *Zool. Jahr. Jena.* 1910, p 128; Slater, *List. Sn. Ind. Mus.* 1891 p 52 (part. No 8386); Wall, *Bomb. N. H. J. Vol. XXII*, p 639; l. c. *Vol XXVI*, p 574; *Spol. Zeylan.* 1921, p 401; *Oph. Tap.* 1921, p, 302; Willey, *Spot. Zeylan.* 1903, p 84.

*Lepid.*—Ventrals. 179 to 202. Subcaudals. 161 to 207.

*Distn.*—Ceylon, Western Ghats. Nilgiris to Travancore.

Genus.—CHRYSOPELEA Boie.

253. (463) **Chrysopelea ornata** (Shaw.) *The Gold and Black Tree Snake.*

*C. ornata.* Abercromby, *Sn. of Ceylon*, 1910, pp 49 and 80; Annandale, *J. A. S., Beng.*, 1904, p 210; l. c. 1905, p 176; Boulenger, *Cat. Vol III*, 1896, p 196; Evans, *Bomb. N. H. J. Vol XVI*, p 170; Ferguson, *Bomb. N. H. J. Vol X*, p 74; Millard, *Bomb. N. H. J. Vol XV*, p 348; Sarasin, *Zool. Jahr. Jena.* 1910, p 134; Slater, *List. Sn. Ind. Mus.* 1891, p 53; Wall and Evans, *Bomb. N. H. J. Vol XIII*, pp. 345 and 614; Wall, *Bomb. N. H. J. Vol XV*, p 525; l. c. *Vol XVII*, p 1035; l. c. *Vol XVIII*, p 227; l. c. *Vol XIX*, pp 757a and 899; l. c. *Vol XXVI*, p 574; *Spol. Zeylan.* 1921, p 401; *Oph. Tap.* 1921, p 305; Willey, *Spol. Zeylan.* 1906, p 230.

*Length.*—1,400 mm. (4 feet, 7½ inches).

*Lepid.*—Subcaudals. 100 to 144.

*Distn.*—Ceylon. Western Ghats of India. South of the Goa gap to Travancore. Bengal. As far West as Patna. Eastern Himalayas. Buxa Dooars to Sikkim. Assam. Burma. Nicobars. Siam. Indo-China. S. China. Malay Peninsula. Malay Archipelago. Sumatra to Celebes. Philippines.

Sub-family 6.—ELACHISTODONTINAE.

Genus.—ELACHISTODON Reinhardt.

254. (452) **Elachistodon westermanni** Reinhardt. *Westermanni's Snake.*

Boulenger, *Cat. Vol III*, 1896, p 264; Sarasin, *Zool. Jahr. Jena.* 1910, p 146; Slater, *List. Sn. Ind. Mus.* 1891, p 48; Wall, *Bomb. N. H. J. Vol XXII*, p 400.

*Lepid.*—Costals. Two heads-lengths behind the head 19, midbody 15, two heads-lengths before the vent 15. Ventrals. 208 to 217.

*Distn.*—Bengal. Rangpur. (Type, Copenhagen Museum.) Purnea (Ind. Mus.) Jalpaiguri. (Bombay colln.)

(To be continued.)



\* THE MAMMALS AND BIRDS OF KASHMIR AND THE  
ADJACENT HILL PROVINCES.

BEING NATURAL HISTORY NOTES.

BY

COL. A. E. WARD.

(*With 7 plates and four photos.*)

The task before me is to write a series of articles on the fauna of Kashmir and the adjacent hills; the idea is to produce a book of reference in a popular form and at the same time not to lose sight of the scientific side.

When describing the larger animals, it may be possible to interest a large number of the readers of this magazine, but the naturalist alone will care to study the notes on the small mammals.

The difficulty ahead is the prevailing fashion of sub-dividing species, and giving generic rank which in many instances is not due.

Environment often conduces to change in size and colour. In many cases these characteristics pass from the parent stock to the offspring, this however cannot be said to be the universal rule, hence latent variations may be found in some of the descendants, in plain language a throw back may occur and these variations may be transmitted; hence great caution is required before the acceptance of a new type.

Take the "Voles" as an example, the variations seem to be endless, and many of the smaller Rodentia present great difficulties in their classification.

Without implying that the naturalist is not in need of further knowledge of large animals, it is undoubtedly the case that by far the largest scope for research is amongst the small mammals such as the rats, mice, bats, etc.

Hence it is proposed to note on the larger animals before passing on to the smaller, for this arrangement will give more time in which all the specimens can be arranged and examined.

CLASS—MAMMALIA.

ORDER—UNGULATA.

In this group are included the four-footed animals which have no claws at the ends of their toes, they are provided with sheaths or hoofs into which the digits fit; these vary in number, for instance the elephant has five in the front and four on the hind foot, and each toe has a sheath.

The horse has one hoof, the ruminants and pigs have cloven hoofs which contain the two central toes, whilst the exterior toes are less developed and do not reach the ground, but here again these two are provided with hoofs.

The cloven hoofs stand flat on the ground and are the only ones of any use to the animal except perhaps when it treads on soft snow or mud, even then very little support would be given to the body; it is reasonable to suppose that in some future stage of evolution these apparently useless toes may disappear.

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\*The following Natural History Notes have been written by Col. Ward as a supplement to his articles on "Big and Small game shooting in Kashmir".

[Eds.]



The feet of the camel do not follow the usual formation of the ruminating quadrupeds, the two toes are enclosed in a common sole and have a fatty covering.

The Ungulates are divided up into various suborders and families, the first to be dealt with is that of the horses.

#### SUBORDER I.—*PERISSODACTYLA*.

##### Family—*EQUIDAE*.

##### THE HORSE, ASS AND ZEBRA.

A single member of this family is found in the area now dealt with:—

THE ASIATIC WILD ASS—*Equus hemionus*, The “Kiang” of Tibetans.

*Distribution*.—Ladak, Turkistan, Mongolia, and in various countries in Asia.

The variety of wild ass known as the “Ghorka” which differs little from the “Kiang” is found in Cutch, Sind and Baluchistan.

*Description*.—The colouring of the upper portion of the body is a ruddy chestnut which varies in tinge, in some specimens being more or less red. Underneath white. A dark brown dorsal stripe extends from the nape of the neck to the tuft of the tail, the hair in this tuft is practically black, so also is that round the coronet and at the tip of the ears.

Height of a stallion shot in Ladak just over 11 hands. The skull  $18\frac{1}{2}$  ins.

Looking at the body of a “Kiang,” attention is at once drawn to the large size of the head, and the small hard hoofs, which look as if contracted.

The “Kiang” is much given to galloping. On the hard stony plains, its great weight and the velocity with which it travels, but for the protection afforded by nature, would destroy the whole structure of the leg.

The foot bone known as the coffin bone of the horse or ass does not fill the hoof, moreover it is provided with passages which permit the flow of the blood to a padding of fleshy material which is elastic, and thus the jar caused is so much reduced as to be innocuous. The leg of a horse presents a most interesting study, it is very complicated and delicate, but the above note indicates why a “Kiang” can gallop over the rocky ground with impunity.

##### *General Notes.*

The wild ass is shy but inquisitive; when suspicious the herd will approach at a considerable pace, then, when the danger is confirmed, they will sometime stand for a second or two, snort and gallop off. A herd may consist of almost any number, but as a rule three to ten or twelve asses are to be seen together.

Many a stalk after wild sheep and antelope is spoilt by the “Kiang.” . . . The photographs, for which I am indebted to Col. C. B. Wood, show three asses standing between the wild sheep and the stalker, and the ending of the chance of a shot, for the “Kiang” have got suspicious and given the alarm.

To the sportsman the “Kiang” is only a disadvantage: the skin is useful for the soles of numdah boots and for patching the coverings of mule trunks. The Tartars will eat the flesh, and so also do the wolves.

Rarely a young “Kiang” is caught and partially tamed, one or two were with the Wazir of Ladak’s ponies and wandered about near Leh, but they were very shy.



KIANG STANDING BETWEEN THE STALKER AND HERD OF GREAT TIBETAN SHEEP (*Ovis ammon Hodgsoni*).  
(Photo by Col. C. B. Wood.)





(Photo by Col. C. B. Wood.)

KIANG GOING OFF, HAVING FULLY SPOILT THE STALK.



## SUBORDER II.—ARTIODACTYLA.

## Section A.—PECORA.

## Family—BOVIDÆ.

## Subfamily I.—Bovinae.

Included in this family are cattle, sheep, goats, antelopes and gazelles, all of which have horns consisting of a core covered with a sheath. These are permanent. In many of the species both sexes carry horns. The genus *Bos* has only one representative in the area dealt with.

THE YAK—*Bos grunniens*.

The "Dong" of Tibetans—also the "Bon-Chour"—is found in Northern Ladak and on most of the uplands of Tibet.

*Description*.—Male. Height 16 hands, a big bull  $16\frac{1}{2}$ ; length 7 ft.; horns 30" to 33" any measurement above this being rare,  $35\frac{1}{4}$ " is undoubtedly a correct measurement of a pair, and 39" has been recorded. The females are smaller and have short horns.

An old bull when standing within about 50 yards looked as if it were a mass of black hair with scarcely any length of leg. These masses of hair hung down nearly to the ground from the shoulders and sides, also from the chest. The tail which does not reach the ground had a very large bunch of black hair over a foot in thickness. After shooting the bull the following notes were made:—

"Colouring blackish but with a brown hue—muzzle grey, hoofs very large, fore legs almost entirely concealed by hair, both at the sides and front, probable weight 900 to 1,000 lbs. Height just over 16 hands."

The photo of a bull yak is unfortunately much fore-shortened, but the horns are clear and show the outward and inward curves, they are 31" long and 17" in girth.

The sense of smell is highly developed, as also appears is that of hearing, it is said that sight is deficient but this seems to be doubtful.

*General Notes.*

Yak are gregarious, seldom found in large herds except in the spring and summer when large numbers of cows and calves congregate on a good grazing ground. Bulls are generally found in parties of three or four until the late summer, when the rutting season commences and extends through July, August and September, then one male is accompanied by four or five or more cows.

The calves are well grown at a year old.

Wild yak cross freely with the Ladaki cattle which are turned out when the pairing season begins. Dr. Heber informs me "The hybrids do not breed at all but the crossing of the yak and cow is quite easy."

The local name of the hybrid is phonetically "Zo" for the male, and "Tsomo" for the female animal. The cross-bred beasts are very sure footed, they are used for riding, and are capable of carrying a load of 200 lbs. on very difficult ground. When the camping ground is reached the yaks are turned out to fend for themselves, up to a certain point they are enduring but when once tired, they lie down and refuse to move. The Ladakis declare that many of the wearied animals get up when hungry and wander off to where they can get grazing, and are retrieved in the following summer.

When starting on a long trip I was pressed to buy a small sized red baggage yak which would bring luck; this animal was seldom loaded for fear the 'mascot' should tire, yet on the return journey, and when within two Marches of Tankse, the driver reported the creature had lain down,

and would not go on and would have to be sent for later. At any rate the purchase of that red 'Zo' was a cheap form of amusement, for the price paid was Rs. 10 only.

There may be some superstition which exalts the red creature into the position of a 'Mascot', but I suspect the Ladaki coveted it and thought of this method of acquiring it.

#### Subfamily ii.—*Caprinæ*.

##### SHEEP—*Ovis*.

This genus is represented by *O. hodgsoni*, *O. ammon* and *O. poli* and allied forms, but these are the three large sheep of Ladak and Central Asia, and in addition there is *O. vignei*, this last has a wide range in both hot and cold climates and also has closely allied races.

##### THE GREAT TIBETAN SHEEP—*Ovis ammon hodgsoni*.

This is the Nyan of Ladakis, and is known to sportsmen as the Ammon, whereas the true *Ovis ammon* is the species found in Siberia and Mongolia.

*Description*.—The ram weighs about 240 lbs. and measures 46" at the shoulder, from between the horns to the tail 5'-4", tail 3".

A very large ram was 47" at the shoulder. Length 5'-5" and scaled 280 lbs.; it owned very thick horns with the points broken off.

There is some doubt as to the size of the largest horns. Rowland Ward's "Records of Big Game" mentions a pair of horns from Tibet as 57". If this was from a Hodgson's ram it is far the longest. Three trophies of 50" to slightly over 51" in length have been carefully measured, one of these had a girth of 19". Horns of 45" with a girth of 17" are good and exceptional.

Judging from many heads of ewes which were picked up, the ewes carry horns of 18", but one pair, found near Haule, was 20" long; they are straight for the greater part of their length and gently twisted at the top. The female is of considerable size and must weigh 150 lbs. or more.

The male is light brown above, and white on the chest, stomach and on the insides of the legs. The ruff is whitish, a dark brown line of long hair extends along the back. Early in the summer the upper portions are greyish brown. When viewed through glasses the white chest and neck are very obvious. Females are brownish on the upper part, the colour merging into a brownish or yellowish-white in the lower parts. I never had a chance of measuring a ewe. The females of the Central Asian sheep are all large.

##### General Notes.

There is no beard. Like the rest of the sheep, the glands under the eyes and in the division of the cleft hoof are present.

Gregarious and migratory, the Hodgson's sheep wander in small flocks from place to place searching for their food, hence in one year numbers may be found in a tract of country whilst in the next season not a single animal can be seen.

The flocks in the very early summer may consist of both sexes and may number from about three or four to ten or more, then as the season advances four or five rams may be alone; the females and young congregate in mid summer.

As recorded in the "Sportsman's Guide" I have seen three lambs with a single ewe, and on two or more occasions, twins.

Shy by nature, also possessing keen powers of scent and sight, these sheep are hard to approach. When they have taken up their summer quarters, having found grazing, the rams may be sighted day after day,





BULL YAK FROM TIBET (*BOS GRUNIENS*).





(Photo by Capt. J. Y. Allan.)

GREAT TIBETAN SHEEP (*Ovis ammon* HODGSON) FROM GOGRA - CHANGCHEN MO.

it is therefore desirable to be patient and to wait until the game is favourably placed for a stalk before making the attempt, for once thoroughly frightened they will trek for many miles and ascend the highest mountains. At the best of times it is useless to expect to find them under 14,000' to 16,000' in the summer.

The open ground, which is the general rule in Ladak, tells both ways for and against the sportsman, it may make the stalk difficult, but it enables the game to be located.

Plate IV shows a Hodgson's sheep left out at night to freeze and photographed in the morning by Capt. J. Y. Allan.

Plate V shows heads of three animals, including a hybrid between a ram of Hodgson's sheep and a Ewe Urial (Vigne's sheep). This hybrid was at one time called *O. brookei*, and was first noticed in the Rampak ravine, Ladak. Three or four of these cross-bred sheep have since been obtained, whether they would produce offspring or not cannot be discovered, but that the two species occasionally cross is not open to doubt.

The pairing season is in the early winter and the Hodgson's ram probably was driven down to the lower ground by the weather and could easily force the Vigne's ram away.

The cross-bred between Vigne's ram and the Hodgson's ewes is more difficult to explain—possibly the ram was killed and ewes were joined after this by the male Oorial. I have only heard of one such hybrid which was shot by Major Cumberland many years ago. The Oorial must have wintered much higher up the hill than is their usual habit, for the Hodgson's sheep rarely come below 13,000'. The Ladakis say that the presence of the ewes of the Nyan must have been due to their being driven by wolves.

SIBERIAN ARGALI—*Ovis ammon ammon*.



Fig. I.—Typical Siberian or Altai Argali. *Ovis ammon ammon* from the Altai.

Shot by Major C. S. Cumberland

The typical race of Ammon is found in Mongolia and differs from Hodgson's sheep in the shape of the horns and in the absence of the white ruff. It has been stated that the Ammon is the largest of the Central Asian



sheep. I have however no record of any that exceeds that of the huge Hodgson's ram which weighed 280 lbs.

There is a considerable difference between an animal shot in April that has gone through 5 or 6 months of semi-starvation, and one obtained in August or September which has been grazing freely for 3 or 4 months. Probably any full grown ram of the larger sheep exceeds 200 lbs. and does not reach 300 lbs. in weight.

The Siberian or Altai Ammon (*O. ammon ammon*) is devoid of the white ruff on the neck, and comes chiefly from the Altai, the southern parts of Siberia, and northern Mongolia. The Mongolian Ammon (*O. ammon mongolica*) is not entirely devoid of the ruff, but the hair is not pure white nor so much developed as in Hodgson's sheep. It is found to the eastward in Mongolia. The type locality being the Gobi Desert of Mongolia.

The Altai animal has very large horns of 60" in length and upwards. Rowland Ward gives the record at 62½" by 19½" in girth.

The second form which for convenience sake has been styled the "Mongolian Ammon" has smaller horns, and in addition differs slightly in colouring. Fig. I shows the Altai Ammon's head, it was shot by Major Cumberland and measures

Length on Curve.	Girth.	Tip to Tip.
56½"	18½"	38½"

This is a typical head, the horns turn abruptly outwards but not downwards at the points. In some specimens there is a slight tendency to do so, but not to a marked degree. See the head of the Siberian Argali. B. N. H. Society Journal Vol. XXVIII, page 336. Below is given a fine specimen shot by Colonel C. B. Wood.

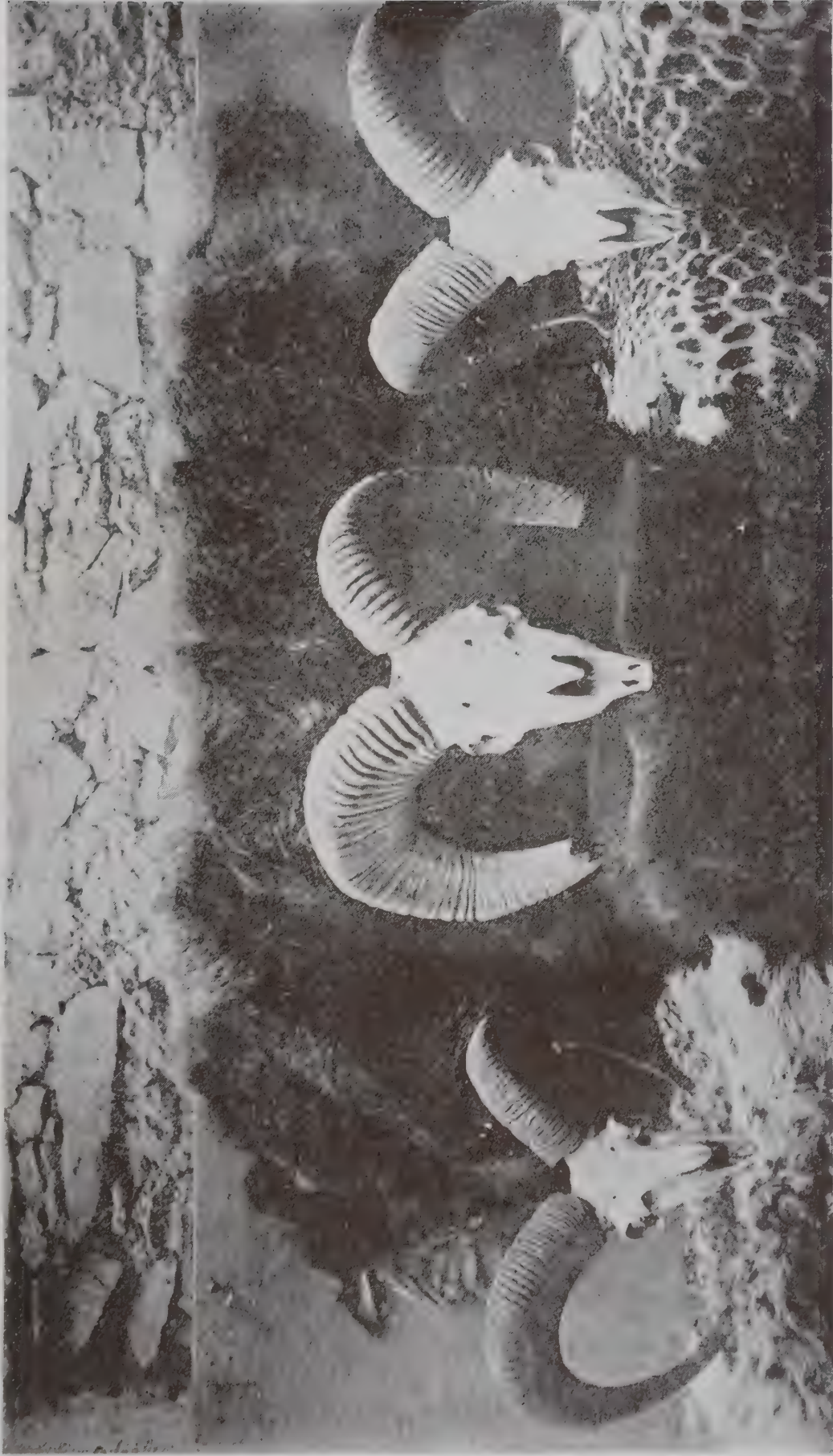


Fig. II.—Siberian Argali (*Ovis ammon ammon*).

From the Altai shot by Col. C. B. Wood.

62½" by girth 19½" Tip to tip 41½".





OORIAL.  
(*Ovis vignei vignei*.)

GREAT TIBETAN SHEEP.  
(*Ovis ammon hodgsoni*)

HYBRID.  
(*O. ammon. + O. vignei*.)  
The hybrid is from Rampak, Ladak.





*OVIS AMMON POLL.*

Shot by Col. G. Sullivan, 63," girth 14 $\frac{3}{8}$ ".

There are three closely allied forms:—one to the westward and south-west of the Altai on the Irtish river and adjacent mountains; this is a smaller race, the horns are more twisted at the extremity and turn downwards, but the habitat of these and other closely allied forms is beyond the geographical scope of this article, in fact the real object of dwelling on the various forms of the Ammon which are outside Ladak and the Pamirs is to point out to sportsmen who visit Kashmir territory that the Great Tibetan Sheep or *O. ammon hodgsoni* is not the true *ammon*.

THE GREAT PAMIR SHEEP—*Ovis ammon poli*.

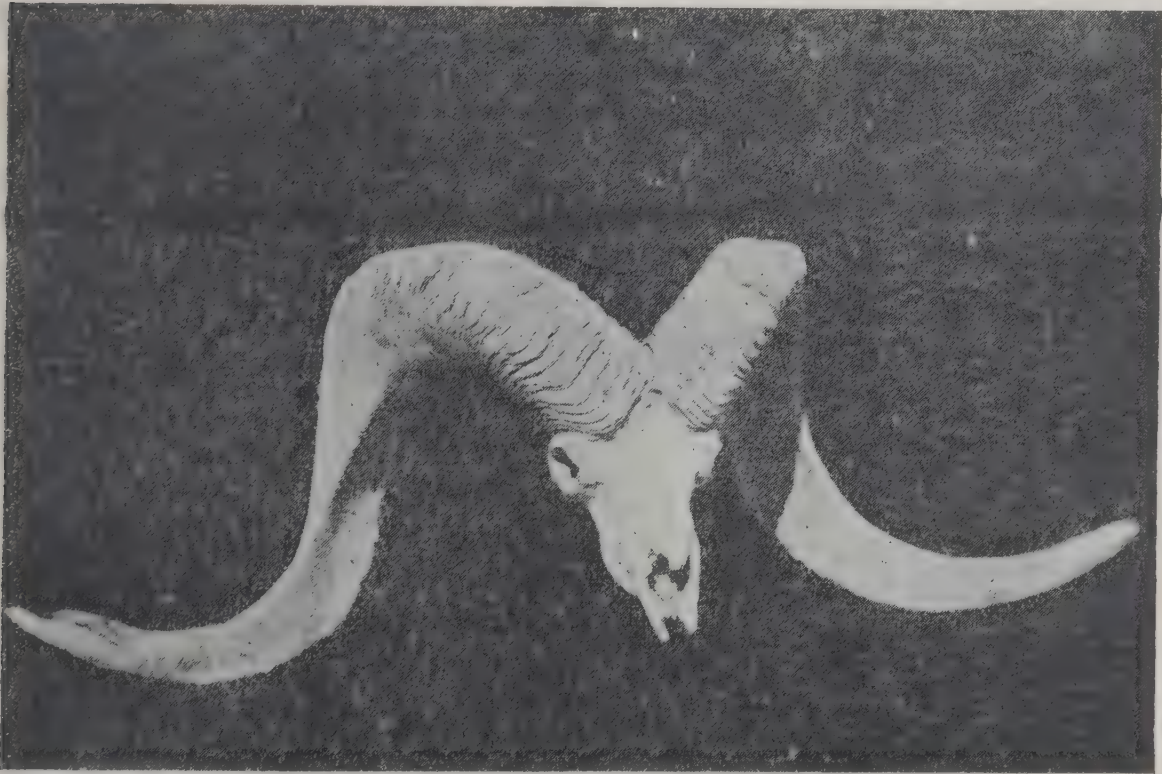


Fig. III.—Great Pamir Sheep. *Ovis ammon poli*. A picked up head brought to Kashmir—1874.

*The Kulja*.—This sheep is in many respects like the closely allied race from Ladak (*O. ammon hodgsoni*). The ram is smaller and measures 43" to 44" at the shoulder and weighs about 220 lbs. The white ruff and dark crest are present in both species, but the Poli has a white muzzle. In this respect it resembles the sheep found in the Irtish and Sair district, which have been briefly alluded to already.

The few skins I have seen of this sheep are darker on the upper body than those of the Hodgson's sheep, the tail is longer, but the chief difference is in the horns which unlike those of the Ammon turn considerably downward at the tips.

The ewe is of large size and has horns which are very similar to those of the Great Tibetan Sheep, and are about 17" long.

The horns were brought down to Srinagar in large numbers between 1875 and 1888. Every collector wanted a specimen and every sportsman who could afford the expense and could get a permit wanted to shoot a ram.



There is not much difference in the general shape of the horns, although some have the downward bend much tucked in towards the sides of the skull, and in others the outward turn is a good deal splayed.

At first there was a good deal of speculation as to whether there were two species of Marco Polo's sheep, and one was tentatively called *Karelini*. This name is now apparently used for an inferior form of *poli* which come from Tian Shan.

As many of the horns were obtained through traders, the exact locality from which they came could not often be guaranteed. The two photos show the horns which were amongst the first to arrive in Kashmir, both, as is evident, were 'picked up heads'. No. 2 is 75" along the curve and is 16" in girth hence it nearly approaches the record of 75" x 18" which used to hang on the walls at Snowden in Simla.



Fig. IV.—Great Pamir Sheep, *Ovis ammon poli*, 75" x 15". One of the first to be brought from "Little Pamirs."

The horns of the Great Pamir sheep do not girth as much as those of the Great Tibetan sheep, (*O. a. hodgsoni*) and out of dozens of heads I have seen none come quite up to 17". A reference to the B.N.H.S. Journal Vol. XXVIII, page 337, will show that, out of the 13 heads of *O. ammon hodgsoni* mentioned, 8 exceed 17" in girth, which is by no means uncommon. Large horns are now seldom seen. The photo of a *poli* shot by the late Colonel G. Sullivan shows what is the best obtained of late years. The length is 63", girth 14½". A good head just under 60" was brought down in 1922, but from all accounts the increase in the number of rifles owned by the Khirgis and others has enabled them to shoot large numbers of *poli* and the many horns lying about point to the reason for the decrease mentioned.

Lately I was told that this sheep had suffered from rinderpest; this is quite possible for the disease has been prevalent in some of the far hills, but the improved rifle is probably the main cause of the trouble.





THE OORIAL (*OVIS VIGNEI*) FROM LADAK.



URIAL OR OORIAL.—*Ovis vignei*.

There is but little difference to be traced between the various sheep which are generally known as the Urial or Vigne's sheep.

The following are the forms of local races:—

1. The Sha or Sharpu of Ladak.      *Ovis vignei vignei*.
2. The Urial of the Punjab.      *Ovis vignei punjabensis*.
3. The Gad of Baluchistan.      *Ovis vignei cycloceros*.
4. The Ouch or Arkhar of Persia.      *Ovis vignei arkar*.

The Urial is smaller than the Sharpu, rarely exceeding 32" at the shoulder whilst the latter stands 34". The weight of the Sharpu is about 125 to 130 lbs., that of the Urial 10 to 15 lbs. less.

The ruff, which is almost black, is fully developed on the Punjab Urial, whilst the Sharpu, although it has a decided ruff in the winter, does not even carry the very dark ruff which in the Urial falls well down the chest.

The Urial horns are not so thick as those of the Sharpu or the Gad. The Ouch or Arkhar of Persia has horns exceeding in length and equalling in girth those of the Sharpu or the Gad.

The Gmelin sheep *O. orientalis gmelini* of Asia Minor is known as the Red Sheep and is allied to those mentioned, but ewes which in all the other races carry small horns do not do so.

After all that can be said in regard to the shape of the horns the variations in colouring and the presence or the partial absence of the ruff, there is practically nothing to justify the separation of these sheep into different species. They extend from the Salt Range of the Punjab to the North-Western Frontier, from Sind to Baluchistan and Afghanistan, and from Ladak to Turkistan and into Persia. With so extensive a habitat it would be strange if there were no variations in size and colour.

The record horns of the Punjab form are figured in Rowland Ward's last edition, they were got by my friend Col. H. V. Biggs, R.E., and taped 36" by 9 $\frac{3}{4}$ " in girth, the points turn upwards rather sharply, more so than is generally the rule.

The finest Sharpu horns are 39"  $\times$  11 $\frac{3}{4}$ ".

The horns also mentioned as near 'Leh' are 36 $\frac{1}{4}$ "  $\times$  11 $\frac{3}{4}$ " and, if they had not been broken at the points would probably have been nearly the record, they are very circular in shape and resembles those of the Afghan Urial (*Ovis v. cycloceros*).

The winter garb of a ram is a greyish-brown or red on the back, the legs have dark hair on the outside, the rest being white as also is the chest and the lower part of the body. The ruff is black in some of the races and induced to rufous in others. As the Summer approaches the colouring is generally less defined and redder.

Ewes are as a rule greyish-brown and keep much the same colouring in both seasons, the under parts are of a paler tinge than the upper.

## General Notes.

Active and shy if at all persecuted, Vigne's sheep is easily tamed and crosses freely with tame sheep. It frequents for choice fairly easy ground but when disturbed will take to the precipices.

Sharpu and Urial kept four miles from Srinagar used to be loose on the hills, and would join the tame flocks when out grazing, they would come back as far as the homestead but did not enter the enclosures, but would stay close at hand and go up hill in the morning. Dogs used to worry them and finally they disappeared and were probably killed by leopards.

(To be continued.)

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY  
No. XLIV  
ON A NEW FIELD-MOUSE FROM NEPAL, WITH A NOTE ON THE  
CLASSIFICATION OF THE GENUS *APODEMUS*.

BY OLDFIELD THOMAS, F.R.S.

(By permission of the Trustees of the British Museum.)

Among the mammals obtained in Nepal by Mr. N. A. Baptista, on behalf of the Bombay Natural History Society's Mammal Survey, are 16 specimens of a mouse quite unlike any we have hitherto received, and evidently a very distinct species.

With a certain superficial resemblance to *Mus pahari* or the Metad, it is really an *Apodemus*, and would seem to be the most western and one of the most southern members of the group with  $2-2=8$  mammæ, of which various species have been described from Burma and further east.

It may be called:—

*Apodemus gurkha*, sp. n.

Size medium. Fur rather soft, but not very long, hairs of back about 8—9 mm. in length; no spines intermixed. General colour dark smoky or bluish—grey, nearest to “deep mouse-grey” of Ridgeway, darker on the back, more drabby on the sides. Under-surface soiled greyish, the hairs slaty for two-thirds their length, washed with greyish white; line of demarcation not sharply defined. Ears medium, blackish, darker than the head. Hands and feet white. Tail rather longer than the head and body, with about 13 rings of scales to the centimeter, finely haired, not tufted, blackish above, dull whitish below, not very sharply defined. Mammæ  $2-2=8$ .

Skull smooth, rounded, with well-filled braincase, somewhat as in *A. mystacinus*, although smaller. Less angular and ridged than in *speciosus*, though faint but distinct supraorbital ridges are present, which do not however pass backwards on to the braincase. Palatal foramina of medium length. Bullæ small.

Teeth with the characteristic structure of the *sylvaticus-speciosus* section of the genus, not as in *agrarius*; tri-lobular character of m3 well marked.

Dimensions of the type:—

Head and body 102 mm.; tail 118; hindfoot 24; ear 16.

Skull, greatest length 29; condylo-incisive length 26.3; zygomatic breadth 14.5; nasals 11; interorbital breadth 4.5; breadth of braincase 12.8; palatal foramina 6; upper molar series 4.2.

*Hab.*—Nepal. Type from Laprak, Gorkha; altitude about 11,500'.

*Type.*—Adult male. B. M. No. 23.11.5.44. Original number 941. Collected 9 May 1923 by N. A. Baptista, and presented by the Bombay Natural History Society. 16 specimens examined.

This species would appear to be most nearly allied to the *A. speciosus* group, of which a number of species and subspecies have been described. But it is readily distinguishable by its dark greyish colour and by the detailed characters of its skull and teeth. The related western forms all have  $1-2=6$  mammæ.

While studying this Nepalese mouse I have again examined the characters that separate the various groups of *Apodemus*, with especial regard to the question as to whether they are all strictly congeneric. The most salient point concerns the considerable differences that exist between *agrarius*, with its near allies *chevrieri* and *fergussoni*, and the *sylvaticus-mystacinus-speciosus* group. These differences, in external form, skull and dentition, have been set



out by Forsyth Major\*, by myself† and more fully and completely by Hinton,‡ the latter giving a good account, with figures, of the dental structure in the various forms.

The characters, however, are inclined to be nearly all inconstant, either individuals or races, and it would therefore seem to be inadvisable to separate the two groups as genera. But none the less I think the subject would be simplified if they were considered as subgenera, the name *Apodemus* to be used for the *agrarius-chevrieri* group and the new name *Nemomys* for the *sylvaticus-mystacinus-speciosus* group, Linnæus's *Mus sylvaticus* being taken as the genotype of the latter.

That these groups are natural is evidenced by the general external appearance of the animals, by the shape of the skull, compressed, ridged, and convex upwards in *Apodemus*, rounded, smooth, and with flat or concave forehead in *Nemomys*, as well as by the various dental characters described, of which the most constant are the trifold structure of the inner side of m3 in *Nemomys*, while bifid in *Apodemus*, and the common presence in the former of an antero-exterior cusplet on m2, this being absent in *Apodemus*.

The following is a list of the more important names which occur in *Apodemus*, arranged alphabetically under their respective subgenera; those of *Nemomys* again divided by the number of mammæ.§

*Apodemus* (s. s.)

*agrarius* (type), *chevrieri*, *coreæ*, *fergussoni*, *harti*, *mantchuricus*, *ningpoensis*, *rubens*.

*Nemomys*.

Mammæ 1-2=6.

*arianus*, *epimelas*, *flavicollis*, *fridariensis*, *hayi*, *hebridensis*, *hirtensis*, *ilex-mystacinus*, *pentax*, *rusiges*, *semotus*, *sylvaticus* (type), *tscherga*, *wardi*, *wintoni*.

Mammæ 2-2=8.

*ainu*, *draco*, *geisha*, *gurkha*, *latronum*, *nigritalus*, *orestes*, *peninsulæ*, *speciosus*.

\* Proc. Verb. Atti. Soc. Tosc. IV, p. 135, 1884.

† P. Z. S., 1912, p. 135.

‡ Hist. Brit. Mamm. II, p. 504, 1914.

§ This division is inserted as an aid to memory, but is clearly no certain indication of the true affinities of the species. Thus *A. (N.) semotus*, with six mammæ is obviously more related to the *speciosus* group, with eight, than it is to *sylvaticus* and its allies.



## THE IDENTIFICATION OF INDIAN BUTTERFLIES.

BY LIEUT.-COLONEL W. H. EVANS, D.S.O., R.E., F.Z.S., F.E.S.

## PART IV.

(With 5 plates.)

(Continued from page 707 of this Volume.)

**F. Nymphalidæ.—The Nymphalids. Key to genera.**

1a (51a). Hindwings channelled to receive abdomen.

1b (48a). F v12 not swollen.

1c (18a). Larva, where known, smooth and the head with horns. Palpi with no long projecting hairs.

1d (4a). F v8 from before the middle of v7. Eyes smooth. Palpi smooth and white. Antennæ longer than half costa, club gradual. F cell closed and upper apex right angled. Body stout.

1e (3). F costa serrate. H pre-costal as a spur forward. Larva with 4 horns on the head.

1 (2). H cell closed.

*Charaxes*, *Ochs.* The Rajahs. (Plate 17).

2 (1). H cell open.

*Eribœa*, *Hub.* The Nawabs. (Plate 17).

3 (1e). F costa smooth. H precostal curved back.

*Prothoe*, *Hub.* The Begums. (Plate 17).

4a (1d). F v8 never from before the middle of v7.

4b (14a). F upper end of cell opposite well before the origin v3.

4c (9a). Palpi white or brown throughout. Antennæ longer than half costa.

4 (5a). F upper end of cell obtuse; v10 ex 7; cell open. Eyes smooth. Antennæ club sharply spatulate.

*Helcyra*, *Fd.* The White Emperor. (Plate 17).

5a (4). F upper end of cell right angled or acute; v10 ex cell. Antennæ club stout, gradual.

5 (6a). Cells closed. Eyes hairy. F v9 from well beyond end cell. H pre-costal forked. Forelegs hairy.

*Dilipa*, *M.* The Golden Emperor. (Plate 18).

6a (5). Cells open.

7 (7a). F v3 much shorter than the mv. Genitalia of ♂ protruding. Eyes hairy.

*Eulaceura*, *M.* The Elegant Emperors. (Plate 18).

7a (6). F v3 nearly equal to the mv. ♂ genitalia not protruding.

7 (8). F origin v8 nearer termen than origin v9. Eyes smooth or hairy. Larva with 2 horns.

*Apatura*, *F.* The Emperors. (Plate 18).

8 (7). F origin v8 nearer origin v9 than termen. Eyes smooth.

*Herona*, *Db.* The Pasha. (Plate 18).

9a (4c). Palpi black or black and white. Antennæ equal to half the costa. Cells open. H pre-costal mostly straight.

9b (12a). F v10 ex 7. Larva with 2 horns.

9 (10a). Palpi very long, black with a white tip.

*Sephisia*, *M.* The Courtiers. (Plate 18).

10a (9). Palpi short, only white at base.

10 (11). Eyes smooth.

*Euripus*, *Wd.* The Courtesans. (Plate 18).

11 (10). Eyes hairy.

*Diagora*, *Snell.* The Sirens. (Plate 18).

12a (9b). F v10 ex cell. Eyes smooth. Palpi mostly black.

12 (13). F end v 12 long before origin of v9.

*Hestina*, *Wd.* The Circe. (Plate 18).

**F. Nymphalidae.—Key to genera.—(contd.).**

13 (12). F v12 ends after the origin of v9.

*Sasakia*, *M.* The Empress. (Plate 18).

14a (4b). F upper end cell opposite origin of v3 or beyond. Cells closed. Antennæ and palpi black.

14b (16a). F upper end of cell right angled. H pre-costal straight or curved back.

14 (15). F lower dev straight. Antennæ equal to one-third costa. Eyes hairy. H v8 ends before apex.

*Calinaga*, *M.* The Freaks. (Plate 21).

15 (14). F lower dev highly curved. Antennæ equal to half the costa. Eyes smooth. H v8 ends at apex as usual.

*Penithema*, *Wd.* The Kaisers. (Plate 21).

16a (14b). F upper apex of cell acute. Eyes hairy.

16 (17). H pre-costal straight. Antennæ longer than half costa.

*Dichorragia*, *But.* The Constable. (Plate 19).

17 (16). H pre-costal curved forward. Antennæ shorter than half costa.

*Stibochiona*, *But.* The Popinjay. (Plate 19).

18a (1b). Larva not smooth.

18b (30a). Larva with tubercles, never with more than a few rows of spiny processes. Palpi and antennæ never black.

18c (20a). Larva on either side with a complete row of very long horizontal pinnate processes. Eyes and palpi smooth. F upper end cell opposite beyond the origin of v3, right angled or acute. Pre-costal well curved forward and arises from well before the origin of v8. F origin v11 from far before the end of the cell, opposite origin v2. Antennæ longer than half costa, club gradual.

18 (19). F cell, if closed, lower dev ends at origin v3.

*Euthalia*, *Hub.* The Barons, Counts, etc. (Plates 19-20).

19 (18). F cell closed and lower dev ends well beyond origin v3.

*Adolias*, *Hub.* The Archdukes. (Plate 20).

20a (18c). Larva without long horizontal pinnate spines.

20b (27a). Larva without long horns on the head.

20c (22a). H precostal from beyond origin v8. Eyes smooth. Cells closed. F upper apex cell acute and far beyond opposite origin v3.

20 (21). Palpi with thin long hairs. H pre-costal forked at end. F v9 distorted and arises just before 8.

*Parthenos*, *Hub.* The Clipper. (Plate 21).

21 (20). Palpi smooth. H pre-costal curved forward. F vs 9, 10, 11 distorted, but 9 rises well before 8.

*Lebadea*, *Fd.* The Knight. (Plate 21).

22a (20c). H pre-costal rises from origin v8. Antennæ club slender.

22b (26a). H v8 reaches apex. Palpi smooth. H pre-costal curved forward.

22 (23a). F v1 highly sinuous, vs 9 and 10 distorted. Cells closed. Eyes smooth. Antennæ equal to half costa.

*Neurosigma*, *But.* The Panther. (Plate 21).

23a (22). F v1 straight.

23 (24a). F lower dev highly concave. H cell open or shut; F shut. Eyes smooth. Antennæ equal to half costa.

*Abrota*, *M.* The Sergeant-major. (Plate 21).

24a (23). F lower dev nearly straight. Antennæ equal to or longer than half costa. Eyes smooth or hairy. Cells open or shut.

24 (25). F upper end cell opposite origin v3 or beyond.

*Liminitis*, *F.* The Admirals, etc. (Plates 21-22).

25 (24). F upper end cell before opposite origin v3.

*Pantoporia*, *Hub.* The Sergeants. (Plate 22).



**F. Nymphalidae.—Key to genera—(contd.)**

26 (22b). H v8 not to apex. Cells open. Eyes smooth. Palpi hairy. F upper end cell opposite far beyond origin v3; v10 ex cell or 7. H pre-costal straight.

*Neptis*, F. The Sailors and Lascars. (Plate 22).

27a (20b). Larva with very long horns on the head and very few processes on the body. Cells shut. Eyes smooth. H pre-costal from beyond origin v8. Palpi smooth. Antennæ equal to half costa, club slender.

27b (29). F v9 not to apex. Palpi very long.

27 (28). F v10 ex cell; vs 10 & 11 free.

*Cyrestis*, Bdv. The Maps. (Plate 23).

28 (27). F v10 ex 7; vs 10 & 11 anastomosed.

*Chersonesia*, Dist. The Maplets. (Plate 23).

29 (27b). F v9 to apex; v10 ex cell. Palpi comparatively short.

*Pseudergolis*, Fd. The Tabby. (Plate 23).

30a (18b). Larva spiny with many rows of spines or knobs (*Melitæa*). F upper end cell opposite origin v3.

30b (35a). Palpi smooth and abnormally long. Eyes smooth. Larva with 2 stout branched horns on the head. Antennæ equal to half the costa, club gradual.

30 (31a. 33a). H not tailed. F apex produced, termen rounded, but apex broadly truncate and termen concave just below.

*Hypolimnias*, Hub. The Eggflies. (Plate 23).

31a (30. 33a). H shortly tailed at v4 and lobed at v1. F apex sharply truncate and falcate.

31 (32). Cells closed.

*Yoma*, Doh. The Lurcher. (Plate 23).

32 (31). Cells open. F termen highly concave in middle and convex between vs 1 & 2.

*Rhinopalpa*, Fd. The Wizard. (Plate 23).

33a (30-31a). H long tail at v1 only.

33 (34). Cells open. F upper apex of cell right angled (acute in rest of group). F apex broadly truncate and concave below; convex above tornus.

*Doleschallia*, Fd. The Autumn Leaf. (Plate 23).

34 (33). Cells closed. F. apex sharp pointed, termen highly convex opposite v2.

*Kallima*, Bdv. The Oakleaves. (Plate 23.)

35a (30b). Palpi not abnormally long and usually more or less hairy.

35b (47). Claws normal and with appendages.

35c (41a). F lower dev, if present, ends well beyond origin v3. Larva with no horns on the head.

35d (37a). F ends vs 6, 7, 8, 9 in a straight line.

35 (36). Eyes smooth. Palpi smooth. Cells open. Antennæ equal to half costa, club gradual or sharply spatulate.

*Precis*, Hub. The Pansies. (Plate 24).

36 (35). Eyes hairy. Palpi more or less hairy. Cells closed. Antennæ longer than half costa, club gradual, stout.

*Vanessa*, F. The Tortoise Shells, etc. (Plate 24).

37a (35d). F ends vs 6, 7, 8, 9 not in line, 9 well back.

37b (39a). Eyes hairy. Antennæ equal to half costa, club stout, gradual. Cell F closed, H open.

37 (38). Palpi hairy.

*Araschnia*, Hub. The Mongol. (Plate 24).

38 (37). Palpi smooth.

*Symbrenthia*, Hub. The Jesters. (Plate 24).

39a (37b). Eyes smooth. Antennæ equal to or longer than costa, club



**F. Nymphalidæ.—Key to genera—(contd.)**

abruptly spatulate. Palpi hairy.

39 (40). H cell closed. F upper end cell acute or right angled, opposite beyond origin v3; v10 ex 7 or cell. Larva spiny.

*Argynnis*, F. The Fritillaries. (Plate 24).

40 (39). H cell open. F upper end cell right angled or obtuse, opposite origin v3; v10 ex 7. Larva with humps.

*Melitæa*, F. The Small Fritillaries. (Plate 24).

41a (35c). F lower dev ends before, at or only just beyond the origin of v3.

41b (46). Eyes smooth. Palpi with long fine hairs at the sides.

41c (44a). F v10 ex 7, v9 ends on costa and v8 behind a line joining the ends of vs 6 and 7. Larva head hornless.

41 (42a). H cell open. F origin v10 well beyond origin v7, v8 very short.

Antennæ equal to half costa, club absent.

*Cupha*, Hub. The Rustic. (Plate 25).

42a (41). H cell closed. F origin v10 just beyond origin v7. Antennæ equal to half costa, club moderate.

42 (43). H no spur from the angle of v4.

*Atella*, Db. The Leopards. (Plate 25).

43(42). H with a spur from the angle of v4 towards v5.

*Issoria*, Hub. The Vagrant. (Plate 25).

44a (41c). F v10 ex cell, v9 ends on apex behind a line joining the ends of vs 6, 7, 8. H with a spur or fold from the angle of v4 towards v5. H cell open. Larva with or without horns.

44 (45). F lower dev ends at or just beyond the origin of v3. Antennæ longer than half the costa, club gradual.

*Cynthia*, F. The Cruiser. (Plate 25).

45 (44). F lower dev ends before the origin of v3. Antennæ equal to half the costa, slender and clubless.

*Cirrochroa*, Db. The Yeomen. (Plate 25).

46 (41b). Eyes hairy. Palpi smooth. H with fold in the wing from the angle of v4 towards v5. Cells closed. F v10 ex cell; v9 ends at apex behind the line joining the ends of 6, 7, 8. Antennæ equal to half the costa, club gradual.

*Terinos*, Bdv. The Assyrian. (Plate 25).

47 (34b). Claws very long and without appendages. Eyes smooth. Palpi white with long thin black hairs. Antennæ equal to half the costa, no club. Cells closed. F v10 ex 7, from well beyond end cell. Larva with 2 fine horns.

*Cethosia*, F. The Lacewings. (Plate 25).

49a (1b). F v1 swollen. Larva spiny with 2 thin horns on the head. Eyes smooth. Palpi slender, smooth. Antennæ equal to half the costa. Cells closed.

48b (50). Posterior tibiæ and tarsi with rows of spines.

48 (49). Antennæ club sharply spatulate. Apex F not truncate.

*Byblia*, Hub. The Joker. (Plate 25).

49 (48). Antennæ slender, clubless. Apex F truncate.

*Ergolis*, Bdv. The Castors. (Plate 25.)

50 (48b). Posterior tibiæ and tarsi without rows of spines. Antennæ slender and clubless. Apex F truncate.

*Laranga*, M. The Dandies. (Plate 25).

51a (1a). Hindwings not channelled to receive the abdomen. Antennæ hardly as long as half the costa. Palpi sparsely hairy. Eyes smooth. Wings sparsely scaled.

51 (52). Antennæ club gradual. H v7 ex 6.

*Pareba*, Db. The Yellow Coster. (Plate 25).

52 (51). Antennæ club short, abrupt. H v7 ex cell.

*Telchinia*, Hub. The Tawny Coster. (Plate 25).

**F1. Charaxes.—The Rajahs. (Plate 17).**

1a (7). Above tawny or chestnut. ♂ more or less toothed and ♀ tailed at v4.

1 (2a). Uph margin broadly pale greenish white, bearing a central series of black rings. Bases chestnut brown, outer half of F dark brown, bearing 2 rows of crescentic white markings.

*durnfordi nicholi*, GrS. (95-115). The Chestnut Rajah. Assam—S. Burma. VR.

2a (1). Uph margin not broadly pale.

2b (6). Unf costa not silver white at base.

2 (3a). ♂ upf border broad black, never with tawny spots at the apex; ♀ with broad white discal band. Below purple tawny.

a. Upf black border immaculate, border broad, equal to one-third of the wing at the dorsum; ♂ never with pale discal band, basal area uniform tawny with only a black bar at end cell. ♀ white discal band immaculate, reaches costa. ♂ with a tail at v4 H.

*polyxena psaphon*, Wd. (90-112). The Tawny Rajah. Ceylon. R.

β. As last, black border narrower. In DSF ♂ some tawny markings appear on the border upf towards tornus.

\**polyxena imna*, But. (90-100). S. India—Orissa. NR.

γ. ♂ upf black border with tawny markings from dorsum to v2 or 3; uniform tawny with a black discal line and bar at end cell. ♀ discal band yellowish white and on inner side of border there are some pale tawny spots inwardly bordered by a lunular line; pale discal band not quite to costa and always with 2 black spots in middle in 5 and 6. ♂ only toothed H.

*polyxena hemana*, But. (85-100). Mussoorie—Kumaon. R.

δ. As last, but very variable; ♂ with several well marked varieties. ♀ discal band white and pale spots on the border mostly white. Typical ♂ with no pale band upf and uph white dots in centre of black spots along border.

*polyxena hierax*, Fd. (80-100). Sikkim—N. Burma. C.

♂ v. *corax*, Fd. No pale band: white spots uph on inner edge of the black spots.

♂ v. *hindia*, But. Upf pale discal band; base fulvous and margin spotted.

♂ v. *hipponax*, Fd. Upf pale band; base fulvous to dark, margin not spotted.

♂ v. *pleistoanax*, Fd. Upf pale band; base dark, margin white spotted and uph with the white discal band from F continued to v3 or 4.

ξ. ♂ upf with no pale discal band; discal line usually absent; very like *corax*. Below darker and more variegated.

\**polyxena agna*, M. (80-100). Karens—S. Burma. NR.

3a (2). ♂ upf black border narrow, bearing tawny spots reaching to the apex and inwardly bordered by a lunular dark line. ♀ never with a pale discal band;

3 (4a). Upf apical spots not above v6. Below purple tawny.

*aristogiton*, Fd. (70-95). The Scarce Tawny Rajah. Sikkim—Burma. R.

4a (3). Upf tawny apical spots into 6. Below ochreous.

4 (5). Below more or less uniform and markings regular; unf black bar mid cell macular; unh dark discal line beyond cell more or less straight, except just beyond end cell. In WSF central band darker.

*marmax*, Wd. (90-120). The Yellow Rajah. Kumaon—Burma. R.

5 (4). Below markings prominent and irregular central band much darker. Unf all cell bars entire; unh dark discal line very irregular and broken, highly concave in 6.

*kahruba*, M. (90-120). The Variegated Rajah. Kumaon—Burma. R.

6 (2b). Unf with a silver white bar at the base of the costa. Above much as No. 3. Below tawny.

*distanti*, Hon. (90-120). The Silver-edged Rajah. VR.

7(1a). Above dark brown with a yellow or whitish discal band. H long equal tails at vs 2 and 4.





F. Nymphalidae. 1. *Charaxes*: 2. *Eriboea*: 3. *Prothoe*.





**F1. Charaxes.**—(contd.)

a. Above pale band narrow and dark yellow.

*fabius cerynthus*, *Fruh.* (70-80). The Black Rajah. Ceylon. NR.

β. Above pale discal band wide, dark in WSE, pale in DSF.

\**fabius fabius*, *F.* S. India—Kangra—Sikkim. NR.

γ. Above pale discal band wide and sulphur yellow; H spotting on termen wider.

*fabius sulphureus*, *Roth.* Assam—Burma. R.

**F2. Eribœa.**—The Nawabs. (Plate 17).

1a (4a). Above dark brown with a broad pale discal band, which does not reach the dorsum H. Uph termen with small white spots on the outer edge of the broad dark border.

1 (2a). Unh dark basal band passes through the outer half of the cell. Above discal band white, broadly blue edged.

a. Upf discal band continued evenly to v5, with 2 adjacent spots beyond in 5 and 6.

\**schreiberi wardi*, *M.* (90-100). The Blue Nawab. S. India VR.

β. Upf discal band tapers at the upper end and just reaches 4; white spot in 5 much nearer apex and with an apical dot in 6.

*schreiberi assamensis*, *Roth.* Assam—N. Burma. VR.

γ. Upf as last, but discal band not into 4, detached spot in 5 very small and spot in 6 absent.

*schreiberi tisamenus*, *Fruh.* Karens—S. Burma. Andamans. VR.

2a (1). Unh dark basal band passes through inner half of cell. Above discal band not blue edged.

2 (3). Above discal band pale yellow, width varies greatly with the season; races only very slightly differentiated.

a. Small, band broad.

*athamas madeus*, *Roth.* (60-75). The Common Nawab. Ceylon. C.

β. Larger, usually 2 pale sub-apical spots upf.

*athamas agrarius*, *Swin.* S. India. C.

γ. Large and very variable.

\**athamas athamas*, *Dr.* Kulu—N. Burma. C.

δ. Smaller and darker.

*athamas samatha*, *M.* Karens—S. Burma. C.

ε. Much larger and very dark.

*athamas andamanicus*, *Fruh.* Andamans. C.

3 (2). Above discal band pale greenish white. Three seasonal forms as in last and width band varies very considerably with the season.

*arja*, *Fd.* (75-85). The Pallid Nawab. Sikkim—Burma. NR.

4a (1a). Above pale yellow or greenish yellow, base H never dark; F with broad black apex.

4b (11). Unh dark discal band through basal half of cell meeting post-discal band at tornus.

4c (7a). Unf curv dark band from base through end cell to sub-marginal lunular band. Upf single pale spot on black apex.

4 (5a). Upf black margin not decreasing towards tornus.

*moori sandakanus*, *Fruh.* (80-85). The Malayan Nawab. Sikkim—Burma. VR.

5a (4). Upf black margin decreasing markedly in width towards tornus.

5 (6) Unh pale area covers more than half wing.

*jalysus*, *Fd.* (75-85). The Yellow Begum. Karens—S. Burma. R.

6 (5). Unh pale area covers less than half wing.

*hebe chersonesus*, *Fruh.* (75-85). Victoria Point. VR.

7a (4c). Unf broad bare end cell extending to base v2; sub-marginal band

**F2. Eribœa.**—(contd.)

continuous, not lunular and nearer cell.

7b (9a). Upf costa dark chocolate brown; upf single row pale spots on margin.

7 (8). Upf and Unf no broad bar from end cell towards discal band. Uph sub-marginal dark band bearing pale spots along the outer edge and blueish lunules along the inner edge.

a. Smaller and paler.

*dolon dolon*, Wd. (80-90). The Stately Nawab. Kulu—Kumaon. R.

β. Upf pale spots smaller and shorter.

*dolon centralis*, Roth. (85-95). Nepal, Sikkim, Bhutan. R.

γ. Upf spots larger than in a. Uph sub-marginal band narrow and blue lunules small.

\**dolon magniplaga*, Roth. (95-105). Assam—N. Burma. R.

δ. Uph more deeply scalloped and uph blue sub-marginal lunules more prominent.

*dolon grandis*, Roth. (95-110). Shan States—Karens. R.

8 (7). Upf and unf broad dark bar from lower end cell along 3 to the discal band, enclosing a large pale spot beyond end cell; spots on margin increase in size to tornus. Uph with a postdiscal dark band.

a. Larger. Usually a postdiscal pale spot in 7 upf. Uph sub-terminal narrow dark bars in spaces up to 6.

\**narcœa aborica*, Evans. (70-75). The China Nawab. Abor Valley. R.

β. Smaller. Upf no spot in 7. Uph sub-terminal dark bars obsolete above 3 *narcœa lissainei*, Tyl. (70-75). Naga Hills. R.

9a (7b). Unf costa white and upf with sub-marginal as well as postdiscal row spots. Uph band as in No. 7. Up and unf bar from lower end cell towards discal band as in No. 8, but much shorter.

9 (10). Upf 2 pale spots end cell; dark margin becoming obsolete at tornus.

*nepenthes*, Gr S. (80). The Shan Nawab. Shan States. VR.

10 (9). Upf single pale spot end cell and 2 spots beyond.

a. Large. Seasonal forms differ much in size and size of spots.

*eudamippus eudamippus*, Db. (100-120). The Great Nawab. Kumaon—Assam. NR.

β. Upf cell all black or very nearly so.

\**eudamippus nigrobasalis*, Lathy. N. Burma. N.R.

γ. As a, but smaller. Uph no blue border to band and outer white spots larger.

*eudamippus jamblichus*, Fruh. Karens—S. Burma. R.

11 (4b). Below no dark bands; large spots end cells, base 2 F and mid costa H; sub-marginal row reddish spots preceded by a blue line and on H followed by a greenish yellow line as well as a terminal blue and greenish yellow line. Above broad black apex bearing one or two pale spots and on H sub-terminal blueish, white centred, line.

\**delphis*, Db. (95-100). The Jewelled Nawab. Assam—Burma. NR.

**F3. Prothoe.**—The Begums. (Plate 17).

1 (2). Above pale yellow, broad black apex and margins. Below variegated red and black. F lower dcv evenly curved.

\**calydonia belisama*, Crow. (110-120). The Glorious Begum. Karens—S. Burma. VR.

2 (1). Above dark brown with a blue band F. Below variegated dark brown and whiteish; H with broad greenish marginal lunules. F lower dcv highly concave at lower end.

a. Upf blue band very broad and not marked with white; complete series terminal blue spots, upper 2 being white.







F. **Nymphalidae.** 4. *Helcyra* : 5. *Dilipa* : 6. *Eulaceura* : 7. *Apatura* : 8. *Heronia* : 9. *Sephisa* : 10. *Euripus* : 11. *Diagora* : 12. *Hestina* : 13. *Sasakia*.



**F3. Prothoe.—contd.**

*franckii regalis*, But. (70-80). The Blue Begum. Manipur, Upper Assam. VR.  
 β. Upf blue band narrow and centrally with white splashes; white marginal spots only in 5, 7 and 8.

\**franckii angelica*, But. Karens—S. Burma. R.

**F4. Helcyra.—The White Emperor. (Plate 18).**

Above glazed white; upf black spots in cell and 1, broad black apex with 2 white spots; uph with a few irregular black discal spots. Below only a thin discal line of black lunules.

\**hemina*, Hew. (65-75). The White Emperor. Sikkim—Burma. R.

**F5. Dilipa.—The Golden Emperor. (Plate 18).**

Above dark brown, ♂ with golden bronzy, ♀ with white, central and discal spots F and whole disc H; upf 2 white apical dots.

\**morgiana*, Wd. (70-80). The Golden Emperor. Kashmir—Shan States. R.

**F6. Eulaceura.—The Elegant Emperors. (Plate 18).**

1 (2). Above transparent pale brown, with dark brown costa F and large spot in 2 as well as margins and discal band H.

*manipuriensis*, Tyt. (75-80). Tytler's Emperor. Manipur. VR.

2 (1). Above dark brown with a continuous white discal band, extending on F from dorsum to 3. Below as in last, glazed pale violet brown with an ocellus in 2 F and H.

\**osteria kumana*, Fruh. (65-70). The Elegant Emperor. S. Burma. R.

**F7. Apatura.—The Emperors. (Plate 18).**

1a (6a). Unf no row of minute sub-apical white dots in 5, 6 and 8.

1b ((3a). Unf no black spots in cell.

1 (2). Upf single discal pale band, macular in ♂ continuous in ♀, in addition to the white apical spots. Above dark brown, no pale band H. Below ocellus in 2 F and H fulvous ringed; dark discal line white edged at upper end.

α. Upf discal band white. Uph ocellus in 2 prominent. Below pale brown.  
*sordida sordida*, M. (60-70). The Sordid Emperor. Sikkim—N. Burma. R.

β. Upf discal band yellow tinted. Uph ocellus in 2 absent. Below pale greenish brown.

*sordida naga*, Tyt. Nagas. R.

(1). Upf 2 pale discal bands in addition to the apical spots. Unh dark discal line pale edged throughout. Above dark greenish brown; ♂ upf markings tawny and inner band crosses cell; ♀ markings white or yellowish white, inner band not crossing cell.

α. Upf outer discal band continuous. Uph mostly tawny; unh complete row postdiscal ocelli.

*ulupi ulupi*, Dok. (65-70). The Tawny Emperor. Upper Assam. VR.

β. Upf outer discal band broken at v4. Uph ♂ only tawny in 5 and 6; ♀ postdiscal spots well defined in 5 and 6. Below pale greenish white.

*ulupi florenciæ*, Tyt. Nagas. R.

3a (1b). Unf with black spots in cell.

3 (4a). Upf 2 discal bands; no sub-marginal spots F or H. Above dark brown and tawny, shot blue in ♂. Below pale tawny, prominent pale discal band unh, no sub-marginal dark band.

*ilia here*, Fd. (70-80). The Tawny Purple Emperor. Shan States. VR.



**F7. Apatura.—(contd.)**

. 4a (3). Upf single white discal band in addition to the apical spots, nearly always sub-marginal pale spots H and often on F. Below bluish white, prominent ferruginous discal and terminal band F and H, which on H meet at apex and tornus.

4 (5). Upf no white streak in cell from base. ♂ above shot brilliant blue.

α. Very large. Blue gloss duller; white markings broad and diffused; upf discal band to v11. Unh ocellus in 2 absent. Uph sub-marginal white markings very large.

*ambica chitralensis*, Evans. (75-90). The Indian Purple Emperor. Chitral—Kashmir. NR.

β. Smaller and all markings more sharply defined. Variable and liable to aberrations.

\**ambica ambica*, Koll. (65-75). Kashmir—Shan States. NR.

5 (4). Upf with white streak in cell from base, sub-marginal spots prominent. ♂ very obscurely blue shot. Uph with white discal band from mid costa to base 1. Body prominently white banded. Very like a *Pantoporia*. (F. 25)

*chevana*, M. (75-80). The Sergeant Emperor. Sikkim—N. Burma. R.

6a (1). Unf prominent small sub-apical white dots in 5, 6 and 8. F end cell opposite origin v3. Club antennæ narrow. Unf prominent spots in cell.

6 (7). Above dark ochreous brown; uph with a straight yellow band; upf discal band of yellow spots, apical spots continued to 3 and a prominent black spot in 2. Eyes hairy.

*parvata*, M. (50-60). The Brown Prince. Sikkim—Assam. R.

7 (6). Above ♂ velvet black, unmarked except for white apical dots. ♀ ochreous brown with a paler discal band, which on H is always irregular.

α. ♂ upf with 3 apical dots.

*parisatis camiba*, M. (45-50). The Black Prince. Ceylon. NR.

β. As last, rather larger. ♀ paler and with pale bands prominent.

*parisatis atacinus*, Fruh. S. India. NR.

γ. ♂ upf single apical dot. ♀ much darker.

\**parisatis parisatis*, God. Kumaon—Burma. NR.

**F8. Herona.—The Pasha. (Plate 18).**

Above dark brown with 2 yellow or white discal bands F and H and a basal streak in 1 F. Unf conspicuous white streak in outer half of 5 to termen.

α. Above bands tawny, very wide and confluent.

\**marathus marathus*, Db. (70-90). The Pasha. Sikkim—Shan States. NR.

β. Above bands tawny and narrow; discal bands H and outer band F macular.

*marathus angustata*, M. Karens—S. Burma. R.

γ. As last but bands in ♂ whitish and in ♀ white.

*marathus andamana*, M. Andamans. NR.

**F9. Sephisa.—The Courtiers. (Plate 18).**

1 (2). Above dark brown with 2 tawny bands F; H tawny with black veins and a dark postdiscal band. In ♀ upf the apical spots are whitish.

*dichroa*, Koll. (60-75). The Western Courtier. Chitral—Kumaon. NR.

2 (1). ♂ above outer discal band and apical and sub-marginal spots white; typical ♀ mostly blue; 2nd form ♀ spots as ♂, but all white except for a yellow spot in cell and on H the tawny colour is replaced by white; 3rd form ♀ as first but with white apex upf.

\**chandra*, M. (75-90). The Eastern Courtier. Sikkim—Karens. NR; ♀ VR.

♀ v. *albina*, Evans. VR.

♀ v. *chandrana*, Evans. R.

**F10. Euripus.—The Courtesans. (Plate 18).**

1 (2). Unh with red basal markings. ♂ H red sub-marginal spots in 1a to 3 a. Darker. H vs broader black and black discal band continued in ♂ to costa, also traceable in ♀; F discal band narrow.

*consimillis meridionalis*, WM. (60-85). The Painted Courtesan. S. India. R.

β. Pale markings broader. Uph black discal band only traceable in ♂.

Unf dark discal band prominently broader at lower end.

*consimilis consimilis*, Wd. Dun—Dawnas. R.

2 (1). Unh no red basal markings. ♂ black with pale spots as in No 1. ♀ in several forms; typical form with a broad white band upf and uph all white except for a narrow sub-marginal brown band.

\**halitherses*, Db. (65-85). The Courtesan. Sikkim—Burma. NR.

♀ v. *isa*, M. As typical form, outer half uph dark brown. NR.

\*♀ v. *nyctelius*, Db. Upf dark brown with apex broadly suffused bluish; uph all dark brown. NR.

♀ v. *cinnamoneus*, WM. As last, but uph outwardly with white streaks. R.

♀ v. *alcathæoides*, DeN. As *nyctelius*, but upf all dark brown. VR.

**F11. Diagora.—The Sirens. (Plate 18).**

1 (2). Upf black bar mid cell; unh dorsum not yellow.

a. Paler, white markings wider.

*persimilis zella*, But. (65-75). The Siren. Simla—Kumaon. R.

β. Darker, white markings narrower. Apex F more produced.

\**persimilis persimilis*, Wd. Sikkim—Assam.

2 (1). Upf no black bar in cell. Unh dorsum yellowish. Development of black markings very variable.

*mena*, M. (75). The Scarce Siren. Dalhousie—Mussoorie. VR.

**F12. Hestina.—The Circe. (Plate 18).**

Upf with broad black veins and spotted borders. Uph veins and border broad bright chestnut.

\**nama*, Db. (95-105). The Circe. Mussoorie—Burma. NR.

**F13. Sasakia.—The Empress. (Plate 18).**

Above black, outer half with prominent pale streaks; upf narrow red basal streak in cell, which unf is much wider; unh some basal red markings below costa.

\**funebis*, Lecch. (125-130). The Empress. Nagas. VR.

**F14. Calinaga.—The Freaks. (Plate 21).**

a. Only fore part of thorax above orange. Unh dull ochreous.

*buddha buddha*, M. (90-105). The Freak. Murree—Kumaon. VR.

β. Darker. Unh pale brown. F more elongated.

*buddha gautama*, M. Sikkim. VR.

γ. Above all pale markings very reduced, sharply defined and clear, not diffused as usual.

*buddha aborica*, Tyt. Abor Valley. VR.

δ. All thorax above orange. Dark with the pale markings reduced. Unh pale slate.

\**buddha brahma*, But. Assam—N. Burma. R.

η. All thorax orange above. Uph tornus broadly orange.

*buddha sudassana*, Melvill. Shan States—Karens. VR.

**F15. Penthema.—The Kaisers. (Plate 21.)**

1 (2a). Upf dark brown with pale yellow spots; large basal streaks in 2 and

3. Uph cell all yellow; sub-marginal and discal spots small, preceded by streaks.



**F15. *Penthema*.—(Contd.)**

*a.* Below reddish brown. DSF with apex produced.

*\*lisarda lisarda*, Db. (125-135). The Yellow Kaiser. Sikkim—Manipur. R.

*β.* Below dull brown.

*lisarda mihintala*, Fruh. Chin Hills. R.

2a (1). Upf black with a blue sheen and all spots bluish; basal streaks in 2 and 3 replaced by spots; all markings smaller. Uph sub-marginal spots shaped like arrow-heads.

2 (3). Uph cell with yellow streaks followed by postcellular streaks, separate from discal spots. Upf long streak in 1.

*darlisa*, M. (125-135). The Blue Kaiser. Shan States—S. Burma. R.

3 (2). Uph cell all black.

*a* Upf long streak in 1. Uph postcellular streaks conjoined to discal spots.

*binghami yoma*, Ellis. (125-135). The Black Kaiser. Pegu Yoma. VR.

*β.* Upf no streak in 1. Uph no postcellular streaks.

*binghami binghami*, W.M. Dawnas. VR.

*γ.* Upf no streak in 1. Uph postcellular streaks conjoined to discal spots.

*binghami merguie*, Evans. Mergui. VR.

**F16. *Dichorragia*.—The Constable. (Plate 19).**

Dark green with small whitish spots F and very prominent zigzag sub-marginal line, single in ♂, double in ♀.

*\*nesimachus*, Bdv. (65-85). The Constable. Kulu—Burma. NR.

**F17. *Stibochiona*.—The Popinjay. (Plate 19).**

♂ above velvet black, ♀ darkgreen; upf white spotted and with a dull blue sub-marginal line; uph prominent row sub-marginal black spots, inwardly blue (♀ green) bordered and outwardly white.

*a.* Uph width of white edging narrower than width of black spots; wider in DSF.

*nicea nicea*, Gray. (60-80). The Popinjay. Kulu—N. Burma. NR.

*β.* Uph width of white edging twice as wide as the black spots.

*\*nicea subucula*, Fruh. Karens—S. Burma. NR.

**F18. *Euthalia*.—The Barons, Counts, etc. (Plates 19 & 20).**

1a (27a). Unh base with 2 spectacle marks in cell, outer one extending to base 5, small ring base 6 and a larger one base 7; these markings variable and may be obscure or absent.

1b (18a). Unf cell entirely open.

1c (4a). H termen straight to just above v3, where it is angled, giving the wing a squared appearance. F vs 11 and 12 anastomosed, 11 and 10 touch 10 & 9; 9 from mid 7. F prominently falcate. Uph ♂ a black band at bases of 6 and 7.

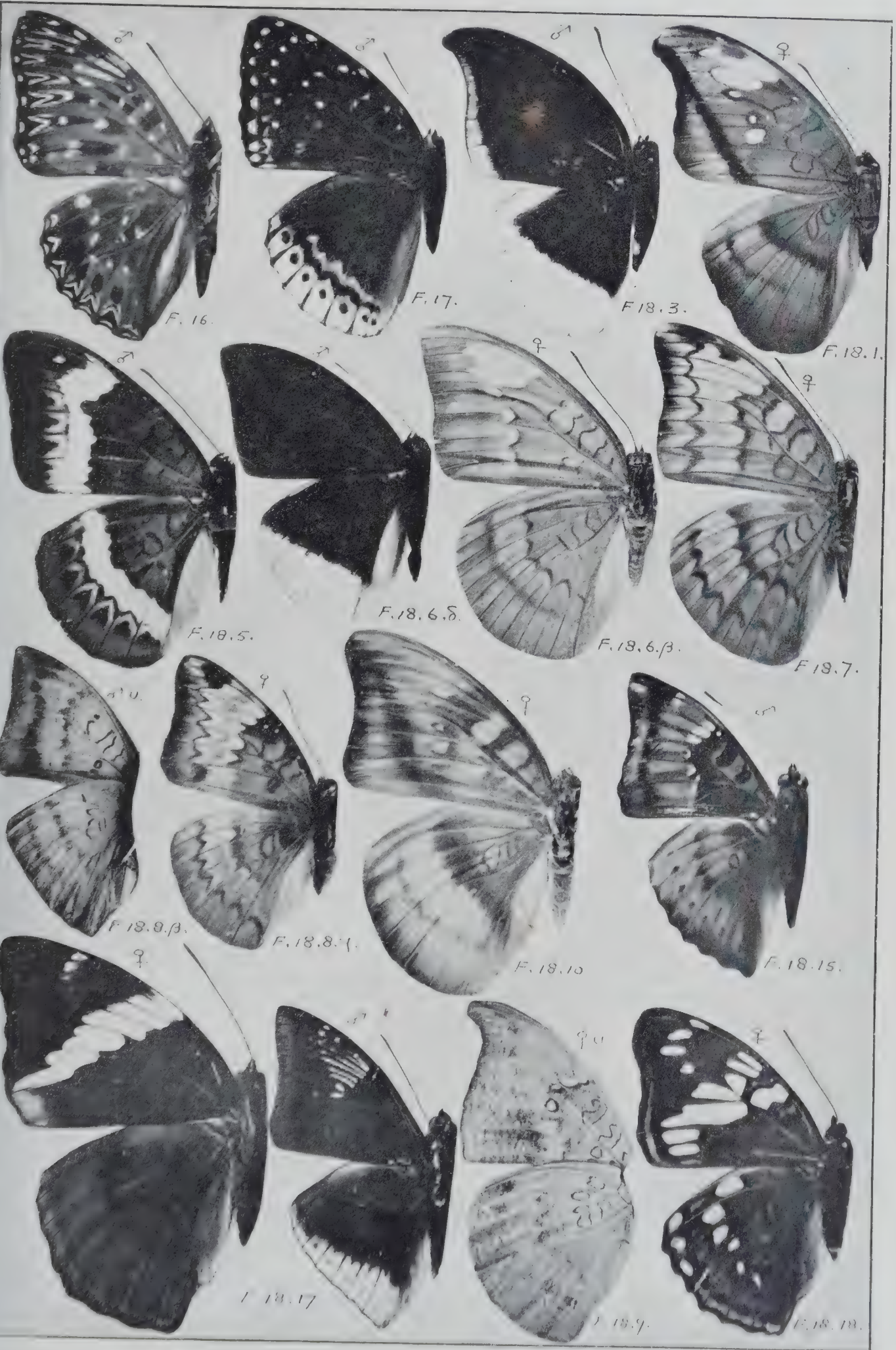
1d (3). Unf post discal line prominent and not parallel to termen, much nearer termen at apex than at tornus.

1 (2). Unf postdiscal line quite straight. ♂ uph with a very broad lavender grey margin extending to v5 F; upf large dark greenish spots in cell and beyond. ♀ pale brown; upf a prominent straight black band from termen at end of v7 to outer third of dorsum, continued on H behind end cell; upf apex greenish and with prominent elongated white spots in 5 and 6, smaller spot beyond in 6, minute spots in 3 and 4 and spot in 2. Below yellowish, margins not paler.

*\*cocytus*, *satrapaces*, Heic. (65-80). The Lavender Count. Manipur—S. Burma. NR.

2 (1). Unf postdiscal line sinuous. ♂ above nearly black with a pale blue border F and H; unf margin bluish; unh all dark brown ♀ above pale brown; upf large dusky white spots in 2 and 3 and elongated spots in 5 and 6, all bordered pale dusky bluish.





F. Nymphalidae. 16. *Dichorragia*; 17. *Stibochiona*; 18. *Euthalia*.





**F18. Euthalia—(contd.)**

*godarti asoka*, *Fd.* (70-80). The Malay Count. Mergui. VR.

3 (1d). Unf postdiscal line waved and parallel to termen. Sexes alike. Uph broad pale margin to v6 F. Below margins prominently paler.

α. Small; borders above very pale grey. Below clouded brown.

*lepidea miyana*, *Fruh.* (65-75). The Grey Count. N. Kanara, Orissa. R.

β. Larger; borders above pale grey.

\**lepidea lepidea*, *But.* (70-80). Kumaon—Assam. NR.

γ. Rather smaller; borders darker grey. Below more uniform, reddish brown. ♀ upf pale brown spots beyond cell.

*lepidea sthanura*, *Fruh.* (65-75). N. Burma—Dawna and Tavoy. NR.

δ. Borders above pale blue.

*lepidea andersoni*, *M.* (70-80). The Blue Count. Tavoy—S. Burma. NR

4a (c). H termen not angled at v3.

4 (3a). Palpi 3rd joint very long and needle like. Above rather pale brown with 2 dark, highly zigzag, discal lines filled in between with white on F. Unf outer half bluish white.

*pelea*, *F.* (70-80). The Malay Viscount. Mergui. VR.

5a (4). Palpi not long and needle like.

5b (8a). Palpi 3rd joint sharply attenuate. H termen evenly convex and wing symmetrical about a central axis from base to mid termen. Upf basal markings in 1 very wide and the ring under origin of v2 reaches v1. F venation as in last group, but origin v9 usually nearer base. Unh with black spots usually at bases 1, 2 and 3.

5 (6a). ♂ ♀ above with a broad white discal band F and H, outwardly bordered by conical black spots, which on H are surmounted by blue spots. Below pale green.

\**cibaritis*, *Hew* (75-85). The Andaman Viscount. Andamans. NR.

6a (5). Above no continuous white band F and H; 2 dark bands parallel to one another and to the termen; these bands may be filled in between with pale colouring on F and on H may be obscured by a pale blue margin in the ♂.

6 (7). Above dark bands not conspicuously lunulated, composed more of diffuse spots.

α. ♂ uph blue margin uph to outer discal band and reaching v6. ♀ rather pale brown with whitish spots upf at the upper end of each discal band in 6. Unh ♂ tornal half green, ♀ all bluish except apex.

*julii antrades*, *Men.* (65-80). The Common Earl. Kumaon—Sikkim. C.

β. Larger. ♂ uph blue margin absent or narrow and broken. ♀ very variable, portion between discal bands upf may be entirely filled in whitish or may be as in last.

\**julii adima*, *M.* (70-85). Khasi Hills. C.

γ. Paler and blue border uph in ♂ broader. Upf dark bands closer and in ♀ often with pale brown large spots in cell and beyond. ♀ as variable as last but smaller.

*julii sedeva*, *M.* (65-80). Sylhet, Cachar. Manipur and N. Burma. NR.

δ. As last, but blue border uph in ♂ still broader, reaches nearly to inner discal band. Above more uniform. ♀ as last, but dark bands H closer together. Unh ♂ and ♀ green or bluish over the whole wing or nearly so.

\**julii xiphones*, *But.* (65-80). Karens—S. Burma. NR.

7 (6). Above discal bands conspicuously lunulated. ♂ rich vinaceous brown, no blue border H. ♀ pale brown, paler between the dark discal bands, often whitish on F especially at upper end. Below ♂ yellowish brown; ♀ yellow, H more or less bluish.

• Larger.

*ujahnu johnu*, *M.* (65-80). The Plain Earl. Sikkim—N. Burma. NR.

β. Smaller and wings broader.



**F18. Euthalia—(contd.)**

*jahnu jahnu*, Evans. (60-75). Karens—S. Burma. NR.

8a (5b). Palpi 3rd joint gradual. Upf basal markings never wide. Unh no or only traces of black spots at bases of 1, 2 and 3. F vs never anastomosed in ♂ and only in ♀ of Nos. 8, 9 and 10.

8b (14a). Up or unf never with 2 detached apical white spots on either side of v7, just behind origin v8, unless forming part of the pale band in the ♀. Upf basal markings in 1 consist of a well defined ring under the origin of v2, reaching mid 1 (in Nos. 8 and 10 usually a small ring or dot below) as well as a dark dot at the extreme base.

8c (10a). Unf at base 1 always a ring or round spot under origin v2 with usually a 2nd below it.

8 (9). Apex F pointed; H tornus in ♂ produced and termen convex. ♂ dark brown with broad bluish grey margin uph and discal band upf, which is very wide at its lower end; a whitish spot base 3 upf. ♂ paler brown with the usual 2 dark discal lines, as in Nos. 6 and 7, area between much paler especially at upper end F; band pushed in at base 3 corresponding to the white spot in the ♂. Below yellow and dorsal area H greenish. ♂ uph a dark band of modified scales at bases 6 and 7.

a. ♂ small and pale; pale brown costal area more extensive; below band obscure especially in DSF. ♀ pale discal band less developed.

*kesava arhat*, Fruh. (50-80). The Powdered Baron. Sikkim. NR.

β. ♂ larger, darker greenish. ♀ whitish discal band more developed especially in WSF. Below darker.

\**kesava kesava*, M. (55-80). Assam—N. Burma. N.R.

γ. ♂ inner side of discal band sinuous. ♀ whitish discal band very prominent, broader and edges more sinuous.

\**kesava discispilota*, M. (50-70). Bhamo—S. Burma. NR.

9 (8). Apex F highly falcate and in ♂ tornus produced, termen being concave before tornus. Above ashy grey, more or less suffused greenish. ♀ with curved row small white spots beyond cell from 3 to costa.

a. Larger and more uniform. ♂ no white costal patch, but a prominent white spot base 3. ♀ upf spots rounded.

*anosia saitaphernes*, Fruh. (70-85). The Grey Baron. R.

β. Smaller, darker and more marmorated. ♂ upf with a white costal patch beyond cell, no spot base 3. ♀ upf spots pointed.

\**anosia anosia*, M. (65-80). Assam—Burma. R.

10a (6c). Unf at base 1 no markings or only a single spot or dash under origin v2 and only very rarely a spot at the extreme base.

10 (11a). Upf cilia white at apex, which is produced, not pointed; H termen evenly convex, tornus not produced. ♂ above very dark brown, with blue margin uph, extending to v3 F. ♀ above rather pale brown, inclined broad dark brown border from apex to two-thirds along dorsum, continued on H to just beyond cell; upf 5 dusky white spots in a curved row beyond cell.

\**telchinia*, Men. (70-85). The Blue Baron. Sikkim—N. Burma. R.

11a (10). Upf cilia brown throughout. ♂ tornus H produced.

11b (13). Apex F sharply pointed and tornus gently convave from apex to v2.

11 (12). Above ♂ very dark brown, broad blue margin H to v6, which inwardly bears a row of black discal spots. Upf termen broadly paler beyond the discal band, which is wide and widens at lower end; inner discal band merged into basal dark area. Below ochreous brown, H dorsal area more or less green washed; the 2 parallel discal bands prominent, on F outer one widens to dorsum, inner one curved in at upper end; H inner band continuous, diffuse and pale, outer one consists of very small spots; apex unf whitish. ♀ unknown.

*mahadeva binghami*, DeN. (65-80). Bingham's Blue Baron. S. Burma. VR.





F. Nymphalidae. 18. *Euthalia*; 19. *Adolias*.





**F18. Euthalia—(contd.)**

12 (11). Uph no blue border. Upf the 2 discal bands more or less separated throughout. ♂ above very dark brown, outer discal band connected in each space by a dark bar to the termen, inner band merged to dark basal area; H outer discal band prominent, inner merged to dark basal area. Below dark ochreous brown, bands as in No. 11 and apex F whitish; in DSF bands faint. ♀ paler, apex upf whitish, discal bands prominent, outer one lunular, but of small spots uph; upf row of white spots beyond cell (small in WSF, large in DSF) from 2 or 3 to costa, as in No. 10. Below pale ochreous brown, more or less washed greenish on H.

*merta eriphyle*, DeN. (60-70). The White-tipped Baron. Assam—S. Burma. R.

13 (11b). F apex not sharp pointed, termen slightly concave in middle only. ♂ above dull dark ochreous brown, very uniform; outer discal band F and inner discal band H very faint. Below yellow, outwardly darker and dorsal area H paler; inner discal bands faint; outer discal band fairly prominent, especially at ends; on H outer discal band of small, obscure spots. ♀ unknown.

*kanda elicius*, DeN. (60-70). The Yellow Baron. S. Burma. VR.

14a (8b). Up or unf always 2 detached white apical spots on either side v7 just before origin v8. Upf basal markings in 1 consist of a spot, not a ring, under origin v2 and a dash at extreme base, both may be absent. Unf spot under origin v2 may be replaced by a ring. ♂ apex F pointed and tornus H produced.

14b (17). None of the spots red.

14 (15a). Uph outer discal band of small, usually well defined and well separated, spots. ♂ with a more or less complete row of small white spots beyond cell in bases 2-6. Normal ♀ similar, but spots larger. Unf spot in 1 of outer discal band shifted in.

*a.* ♂ very dark. ♀ upf with a stright white macular discal band from costa beyond cell to v2 near termen. Upf apical spots obscure.

*garuda vasanta*, M. (60-75). The Baron. Ceylon. C.

*β.* Very large. ♂ basal area dark; discal spots small or absent; discal area dusted whitish. ♀ discal spots large, pure white, discal area beyond prominently dusted whitish.

*garuda meridionalis*, Fruh. (65-80). S. India—N. Kanara. C.

*γ.* Small and pale. ♂ upf discal spots small, but those beyond end cell always present. ♀ discal spots small and dusky, spots in 2 and 3 small or absent.

*garuda anagama*, Fruh. (55-75). Bombay—Orissa. Kangra—Kumaon. NR.

*δ.* Darker than last and discal spots upf smaller.

*garuda suddhodana*, Fruh. (55-75). Bengal. Sikkim. NR.

*η.* WSF dark and spots upf complete and prominent. WSF ♀ spots as in ♂; DSF ♀ spots end cell very large and confluent, spots in 2 and 3 may be small or absent.

*\*garuda garuda*, M. (55-80). Assam—Burma. NR.

*ξ.* Very large. ♂ dark and discal spots obscure, apical spots prominent and outer discal band wide. ♀ with complete discal band as in *a*, but more diffused and linked Y-wise to the apical spots; discal band continued widely on H between the dark discal lines.

*garuda acontius*, Hew. (65-85). Andamans. NR.

15a (14). Uph outer discal line continuous or absent, but never of well separated small spots.

15 (16). Upf white streak at termen in 7, which on unf extends into 6 and 8. ♂ above very dark brown, outer discal band broad and inclined inwards, being continued on H as the inner band. Upf beyond cell a series of double spots in 3-6, the lower one in 5 being continued as a streak so as to meet a lower spot in 6. ♀ paler and outer discal band narrower.

*a.* Small, pale and markings narrow.

**F18. Euthalia—(contd.)**

*jama jamida*, Fruh. (55-75). The Streaked Baron. Sikkim. NR.

β. Larger and darker. ♂ upf white streaks prominent above in WSF, absent in DSF.

*jama jama*, Fd. (55-85). Assam, Manipur. NR.

γ. As last, but smaller and never so dark. ♂ upf white streaks nearly or quite obsolete.

*jama verena*, Fruh. (55-80). Burma. NR.

16 (15). Upf no white streak at termen in 7. ♂ upf marked as in last, but outer discal band is parallel to margin and white streaks very prominent; uph margin broadly pale blue to v6 and termen narrowly pure white. ♀ quite different, paler brown with a broad white discal band upf from costa to termen at v1; 2 prominent apical spots.

\**phemius*, Db. (65-70). The White-edged blue Baron. Sikkim—Burma. NR.

17 (14b). Above dark green with red spots H and in cell F. ♂ upf a Y-shaped discal band of small white spots and ♀ with a large white spot before end cell as well as a macular white discal band. Uph outer row dark spots sub-marginal, not discal.

α. Upf sub-marginal band much broader. In ♂ there is a strong contrast between the dark basal and the green marginal areas. ♀ outer edges of the 2 spots in 1 and lower edge spot in 2 not to termen, in line with spot in 3.

*lubentina psittacus*, Fruh. (65-80). The Gaudy Baron. Ceylon. NR.

β. ♂ above nearly uniform dark green, but paler than other races. ♀ more brilliant pale green, upf band narrow and sharply defined.

*lubentina arasada*, Fruh. (60-80). S. India.

γ. Dark and uniform. Considerable seasonal variation.

\**lubentina indica*, Fruh. Bombay—Bengal. Kangra—Burma.

18a (1b). Unf cell closed or at least with a small spur from base of v5. Mostly dark green.

18 (19a). Upf a sub-marginal row white spots; white discal band to just beyond mid dorsum and on H to v2. Below shining pale greenish blue. F cell not fully closed. Upf and unf no basal markings in 1.

α. Above white discal band broad and all markings slightly diffused.

*franciæ franciæ*, Gray. (75-90). The French Duke. Sikkim, Nepal, Bhutan. R.

β. Above white discal band narrow and all markings sharp.

\**franciæ rajah*, Fd. Assam—Karens. R.

19a (18). Upf no row of sub-marginal white spots. F cell closed.

19b (26). Apex F not falcate; no red spot in cell upf. Usually prominent pale discal band upf. Upf at base 1 a ring and a dot usually under origin v2.

19c (21a). Upf white discal band vertical, reaches dorsum just beyond middle; on H discal band to v1 and outwardly bordered bright greenish blue. H cell open; F vs 11 and 12 anastomosed.

19 (20). Uph white discal band not black edged outwardly before the blue area. *duda*, Stg. (90-100). The Blue Duchess. Sikkim—Assam. R.

20 (19). Uph white discal band outwardly black edged.

α. Uph blue area not formed into lunules except near costa.

\**durga durga*, M. (95-105). The Blue Duke. Sikkim—Abor. R.

β. Uph blue area formed into blue lunules throughout. The discal band upf and all the markings below broader.

*durga splendens*, Tyt. Nagas. VR.

21a (17c). Upf white discal band, if present, directed to tornus and not extending below v2. Cell H shut; Fv11 free.

21 (22a). ♂ above bronzy olive green, no white discal band; upf large dusky pale spots in 2 and 3; uph prominent yellow area in 6 and 7. ♀ upf with a rather narrow white discal band, spot in 4 narrow, elongate, pointed and well separated from the spots on either side.



**F18. Euthalia—(contd.)**

\**nara nara* M. (70-95). The Bronze Duke. Sikkim—N. Burma. R.

β. Above bright dark green, *nara shania*, Evans. Shan States.

22a (21). ♂ upf with pale discal band; ♂ ♀ with spot in 4 conjoined to spots on either side.

22 (23a). Uph ♂ ♀ continuous curved discal band from costa to v4; upf discal band narrow and dusky at lower end, upper spots small, that in 4 smaller than the rest. Above shining bronzy olive green.

*curvifascia*, Fd. (75-95). The Naga Duke. Nagas. Manipur. VR.

23a (22). Uph discal band macular and upf spot in 4 as large as the rest; discal band in the ♂ pale yellow, in ♀ white usually.

23 (24a). Upf discal spot in 4 so placed that its inner edge is in line with the inner edge of spot in 5 and against the middle of the spot in 3.

α. ♂ uph the discal spots extend to 1 and beyond the spots in 5 and 6 the wing is conspicuously paler, showing up the very broad postdiscal dark band.

*sahadeva sahadeva*, M. (80-105). The Green Duke. Sikkim—Bhutan. NR.

β. Darker. ♂ uph discal spots at most only to 2. ♀ uph usually only spots and in 6 & 7 and often none at all.

\**sahadeva nadaka*, Fruh. Assam—Manipur. NR.

γ. Smaller, paler and with a less bronzy hue. All spots smaller and paler.

*sahadeva narayana*, GrS. N. Burma—N. Shan States. NR.

24a (23). Upf discal spot in 4 so placed that its inner edge is in line with the inner edge of the spot in 3 and opposite the middle of the spot in 5.

24 (25). Uph all spots well separated; upf all spots very large and with their outer edges pointed.

*iva*, M. (115-125). The Grand Duke. Sikkim—Manipur. VR.

25 (24). Uph spots in 6 and 7 at least contiguous; upf spots more or less blunt.

α. Upf no white spots in 1; upf discal band yellow in ♂ and white in ♀.

*patala patala*, Koll. (85-105). The Grand Duchess. Murree—Nepal. NR.

β. Upf or unf 2 small white spots in 1. Upf discal band yellow in ♂ and ♀, all spots elongated. Below paler and spots on H more complete.

*patala taoana*, GrS. (100-120). Manipur—Karens. R.

26 (17b). Apex F falcate. Upf red spot in cell. Above no white band. Upf no markings base 1. Cells shut.

α. ♂ dark, ♀ paler, olive green, basal areas darker.

*evelina evelina*, Stoll. (75-100). The Redspot Duke. Ceylon. R.

β. ♂ shining green; upf with a white costal patch beyond cell; ♀ paler, the whole discal area between the basal and dark marginal area is whitish.

\**evelina laudabilis*, Swin. S. India. R.

γ. Above brown.

*evelina derma*, Koll. Assam—S. Burma.

27a (1a). Unh with 2 spots in cell, which may be reddish and no markings in 5, 6 and 7.

27 (28a). Above tawny orange with black markings. Cells open.

\**nais*, Forst. (60-70). The Baronet. Ceylon. S. India—Dun—Sikkim. NR.

28a (27). Above brown, with a white band or spots. Cells faintly closed.

28b (30). Uph white spots in 6 and 7 not conspicuously far larger than the rest. Upf and uph a complete discal band (except ♀ of No 29 β) ending on F just beyond mid dorsum.

28 (29). Upf upper spot of discal band in exact line with rest. Uph 1 or 2 small red tornal spots.

*recta*, DeN. (65-85). The Redtail Marquis. Assam—Burma. R.

29 (28). Upf upper spot of discal band shifted in. Uph red tornal spots.

α. Below pale ochreous brown. Upf discal band decreasing slightly, but evenly, to costa. Sexes nearly alike.



**F18. Euthalia—(contd.)**

*\*teuta teuta*, M. (65-85). The Banded Marquis. Assam—Arracan. R.

β. ♂ as last but discal band much narrower and uph postdiscal black spots usually joined to form a lunular line. ♀ very variable: upf discal spots may be small and complete, increasing in size to costa, or some or all may be absent, being sometimes replaced by black spots; uph similar, but the discal spots never below v4. Ground colour in ♀ may be pale or dark brown and the area between the 2 discal rows of spots upf may be greenish blue. Below pale lavender grey to ochreous brown.

*\*teuta gupta*, DeN. Dawnas—S. Burma. VR.

γ. Below pale glazed violet brown. Above as α in both sexes, but upf in ♂ spot in 5 very small; ♀ spots at upper end of discal band very large and at dorsal end very small, spot in 1 double.

*teuta teutoides*, M. (65-90). Andamans. R.

30 (28b). Upf spots in 6 and 7 very large and contiguous. Above rather pale brown; upf with 2 discal spots in 1, one in each 2, 3 and 6; a spot in mid cell flanked white on either side. Upf small white spots in 1-5 directed to mid dorsum and not to tornus as usual.

*\*dunya*, Db. (85-100). The Great Marquis. S. Burma.

**F19. Adollas.—The Archdukes. (Plate 20.)**

1 (2a). Palpi below greenish brown in ♂; whitish in ♀. Antennæ black above. ♂ upf velvet black with a few whitish spots in and beyond the cell; ♀ with numerous white spots. Below indigo blue at base F; apex F and all H dark green; spots white.

*cyanipardus*, But. (110-135). The Great Archduke. Assam—Karens. R.

2a (1). Palpi below reddish brown.

2 (3). Antennæ black above. Below ♂ ferruginous brown.

a. ♂ upf practically unspotted and the blue border vestigial; uph blue border narrow and mostly purple. ♀ above spots bluish white; below ochreous brown and H hardly or not at all green washed; upf spots at bases 2 and 3 large.

*khasiana khasiana*, Swin. (80-105). The Dark Archduke. Assam. NR.

β. ♂ upf markings more developed, uph blue border broader and mostly blue, turning to green at the tornus. ♀ spots pale yellow upf and dark yellow uph.

*\*khasiana intermedia*, Tyt. Manipur, NR.

3 (2). Antennæ prominently yellow tipped above. Below ♂ pale ochreous brown. ♂ blue border upf broad and small spots in and beyond cell prominent, yellow; uph blue margin very broad, blue at upper end, green at tornus. ♀ all spots yellow; upf spots at bases 2 and 3 small.

*\*dirtea jadeitina*, Fruh. (80-105). The Archduke. Manipur—Burma. NR.

**F20. Parthenos—The Clipper. (Plate 21.)**

Above some shade of green with very large discal white spots F; uph on disc the veins are black and there are 2 black lines between each vein, followed by a series of sub-marginal black markings.

a. Above pale greenish grey; F white spots very large; uph sub-marginal markings consist of narrow flattened lunules.

*\*sylvia cyaneus*, M. (115-130). The Clipper. Ceylon. NR.

β. Above greenish golden; F spot end cell as large as spot in 3. Upf sub-marginal markings are conical spots, heads rounded.

*sylvia virens*, M. (105-125). S. India. R.

γ. Above rather pale bluish green. DSF upf with the apex whitish and the white spots more contiguous.

*sylvia gambrisius*, F. (95-110). Bengal—Burma. NR.

δ. Above moss green, below paler; upf apex white tipped.

*sylvia ræpstorffi*, M. (95-110). Andamans. NR.





**Nymphalidae.** 14. *Calinaga*; 15. *Penthema*; 20. *Parthenos*; 21. *Lebaea*; 22. *Neurosigma*  
23. *Abrota*; 24. *Timinitis*.





**F21. Lebadea.—The Knight. (Plate 21).**

*α*. Larger, bands above broader; upf inner edge spot in 2 vertical; uph discal band fills base 3.

*martha martha*, F. (62-75). The Knight. Sikkim, Nepal, Bhutan. NR.

*β*. Smaller, not so bright and bands narrower; upf inner edge of spot in 2 curved; uph discal band just enters base 3 in ♂ only.

*martha ismene*, Db. (60-70). Assam—Manipur. NR.

\*. Still smaller and bands very narrow; uph band not entering base 3 at all.

*martha attenuata*, M. (55-65). Burma. NR.

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*Note*.—Numbering on Plates 19 and 20 under Genus F. 18. to be altered thus:—15 to 14: 17 to 16: 18 to 17: 19 to 18: 21 to 20: 22 to 21: 24 to 23: 27 to 26: 28 to 27: 30 to 29: 31 to 30.

## THE RED ANT.

BY

MAJOR R.W.G. HINGSTON, I.M.S.

*(Continued from page 693 of this volume.)*

Part III.

## SPECIAL SENSES AND INSTINCTS.

*(With one text figure.)*

*Sight—Hearing—Taste—Touch—Smell—Directive sense—Experiments on directive sense—Communication of danger—Establishment of rest camps—Construction of bridges—Enemies of red ants—Seasonal activity—The Queen—Duties of diminutive workers—Nakedness of larvae—Economic position of ant—Order in the commune.*

I come now to the consideration of the special senses by which these ants are guided in their daily toil. They have a highly developed faculty of vision, far superior to that possessed by the generality of ants. Some species seem to distinguish only light from darkness, others are totally blind, but the red ant can recognize different objects, fixing them with its coal-black eyes.

I make some simple experiments on one of their workers. I move a stick across its line of vision; its attention is aroused; it points its antennæ in the direction of the stick, and with them follows each successive movement as I transfer the object from place to place. Certain other kinds of ants would have taken no notice, but this species easily detected the movement over a distance of six inches or more. Such superiority of vision must be important to an ant which spends most of its existence wandering in the trees. It is by means of this sense that they communicate danger, that they detect their enemies and the movements of their prey, and that they calculate the spaces in the midst of the foliage across which they may have to climb. They have a peculiar habit of erecting their antennæ and of giving their abdomens a sudden flick when their attention is momentarily aroused. This permits us to determine the extent of their vision and the particular service that it is to these ants. They noticed the vibrations of the blades of a forceps held four inches away, and I think that they could detect the movement of my hand at a distance of five or six feet.

As is usual in the case of other kinds of ants, I could find no indication of any auditory sense. I fired a shot from my collecting gun six inches from their line of march. There was no disturbance, no interruption in the even regularity of their course. I repeated the experiment near the entrance to a byre. A few on the exterior seemed to appreciate the shock; it was unlikely that they actually heard any sound, more probably they observed the sudden jerk resulting from the sharp recoil. I also blew a whistle within three inches of the byre, but I could not see that it had any effect on the ants. Certainly their sense of hearing must be extremely slight, if indeed it exists at all. They are very sensitive to intrusion when employed in their byres, and if they had heard the noise of the gun or whistle they would surely have poured through the gates of the chamber in their usual tumultuous swarm.

Ants, which are so fond of sweet limpid fluid, are certain to possess some sense of taste. See the way they heap themselves around a spoonful of syrup and there will be little doubt that they enjoy the flavour of the food. On the contrary they are nauseated by the juices of the *Monophlebus*; when some of the substance gets into their mouths they try to brush out the unpleasant taste. I induced some of them to sip a solution of quinine. They became agitated, ran a little distance to one side, tried to cleanse their mouth-parts with their fore legs, and were clearly much discomfited by the bitter substance which they had so foolishly tried to devour.



Of course they possess a sense of touch, that common attribute of all living matter in every form and shape. But in addition to the grosser tactile appreciations, they are very sensitive to the effect of a thrill, clearly perceiving the sudden vibrations which follow a sharp tap upon a branch. Yet they are able to discriminate with some nicety in this matter, for they do not confuse such adventitious tremors with the natural vibrations which occur in a wind or the beatings of the drops of rain.

Like other ants, which move in long columns or processions, they recognize their road by the faculty of smell. Without some guide they could not accurately follow one another in their long journeys in search of food. I rubbed my moist finger across the track while the workers were moving in a continuous stream. A considerable disturbance immediately followed. The steady flow of labour ceased, and a barrier appeared to intercept their course. When the workers reached the line made by my finger they were brought to a sudden halt. They were disconcerted, they sprang backward, they attempted again to make an advance, but their progress was as completely checked as if they had come face to face with a wall. The blockage, however, did not last very long; some of the workers made little lateral explorations, managed at last to find their way across the gap and picked up the scent on the opposite side.

I placed a small lump of camphor on their track as they advanced along the branch of a tree. There was an immediate interruption in the regularity of their march. Many of the workers came to a halt, their sense of sight being, no doubt, affected in addition to that of smell. They gathered in a ring around the strange obstruction; had it been a piece of stick they might have tried to shift it, but they perceived the unpleasant odour of the camphor and kept a safe distance away. I placed a nodule of the substance on the outside of a nest. It caused no particular flurry or excitement. The ants just quietly withdrew from the area so as to leave an open space around the lump. I then removed the camphor and the ants immediately re-occupied the ground. I tried them in the same way with the oil of eucalyptus and the aromatic oil of aniseed. But the ants appreciated the odours of these fluids and withdrew from the unpleasant smell.

It is natural to inquire how these streams of ants can find their way amidst the branches of the trees. They do not march in a haphazard manner, just wandering aimlessly as inclination moves them; on the contrary each individual stream has its own established course. The procession, after leaving a particular chamber, keeps to a fixed path. It bends and turns from one branch to another; it meets and coalesces with adjacent streams; for some distance they may move in a common flow, but at length the first stream leaves the main current to follow its own special course.

How is it that each of these living streams is not lost in the innumerable turnings of its path? I have already shown that by scent they recognize their road. But this, I feel sure, is not their only guide. For when the minor streams from the branches, after blending into the main stream, come to the point where they have to separate again, then, if they just kept to a scented road, they would naturally follow the main current instead of unerringly turning from the path. I established a bridge about one foot in length between a branch and one of their byres. The ants soon learnt to make use of the structure, since I blocked their alternative route. I removed it as soon as they had grown accustomed to the change, and replaced it immediately by a similar bridge over which no ants had previously crossed. I anticipated that the ants would have been very much at loss owing to the removal of their scented road. But they did not show extreme discomfiture. After the usual display of hesitation and excitement they made their way along the new bridge and did not seem very inconvenienced by the change. It would, therefore, appear that they had some other guide in addition to the faculty of smell.



Can it be that sight is a supplementary aid? These ants, as we have learnt, have strong visual perceptions. Perhaps by the inspection of the objects on their route they know that they are on the true road. At a point where a branch divided into a fork there was a choice of courses open to the ants. They could take the road to the right which would lead them to their byre, or the one to the left which would lose them in the leaves. There was a steady stream along the road to the right since the ants at the time were busily engaged in transporting cattle to the shed. I surrounded this road with a white strip of cloth, fixing it one inch from the bifurcation of the branch. I left it in position for twenty-four hours. The ants had by then become accustomed to it, and, as it was a very conspicuous object, they must surely have fixed it as a landmark on their path if they were guided at all by sight. I removed it from its place on the next day, and at the same time transferred it to a corresponding position on the road that led to the left. Now, if the ants were in any way directed by sight, they ought to have thought themselves on the wrong track when they found that their landmark had disappeared. Also they might have seen it on the path to the left, and, as a consequence, have turned in that course. But the facts were otherwise. The disappearance of the cloth did not confuse the ants. They continued to take the road to the right with the same deliberation as before. The ants, in their power to recognize the road, are not guided by the faculty of sight.

Sight being, in this way, placed out of account, and smell being, at best, only a partial influence, we are forced into the idea of a directive sense, some faculty of feeling the true direction in a manner unintelligible to us. The following experiment will indicate what I mean. I arranged two sticks like the letter T (see diagram) and trained the ants to move along them in order to reach their byre. There was a pivot at the junction of the two limbs of the T, so that the horizontal one could freely rotate on the vertical one by turning it to either the right or left. I allowed the apparatus to remain in position for two days in order that the ants might become accustomed to the route.

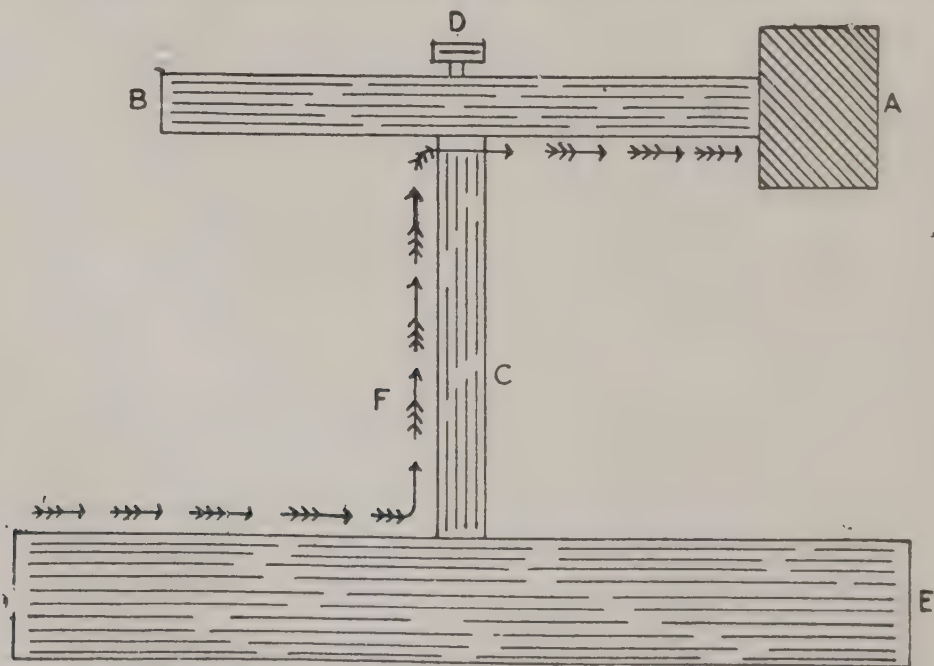


Diagram of experiment on directive sense.

- a. Byre.
- b. Horizontal limb.
- c. Vertical limb.
- d. Pivot.
- e. Branch of tree.

The arrows indicate the track of the ants.

The illustration will indicate the direction of their course. They had first to ascend the vertical limb, then make a rectangular turn, then advance along the right half of the horizontal limb at the end of which they found their byre. When they were perfectly familiar with the direction of the route I thoroughly purified the left half of the limb in order to deprive it of any trace of scent. The right half was now scented and led to the byre, the left half was unscented and ended blindly in the air. The train of ants was moving along the right half on their way to and from the byre. I now rotated the horizontal limb so that the portion which previously led to the left now became the road to the byre. The point which demands attention is this. What will the ants now do when they reach the top of the vertical stick? How will they turn, to the right or to the left? If to the right, then it is clear that they are guided by the sense of direction, for that is now the unscented side and it is in the direction of their previous course. If to the left, then they must be guided by the sense of smell, for it is on that branch of the limb that they previously travelled and it therefore retains the scent. I take note of twenty successive workers on their journey from the tree to the byre. Nineteen of them turn without hesitation to the right and proceed direct to their goal; only one happens to go astray by making its turn to the left. Two out of the nineteen certainly hesitate and first move an inch or so to the left, but this, I think, is of little significance, for the ants do the same in their ordinary journeys; they frequently appear a trifle confused at points where the branches join, and will run a few paces in a wrong direction before following the true road. Thus the conclusion appears to be clear. The ants are under a powerful directive influence; it is infinitely superior as a guiding force to the more intelligible faculty of smell. It is this force which mainly directs their journeys. The scent may help to keep them to the general track, and to distinguish a branch which has been traversed by the workers from one over which none have moved. But their essential guide is the directive sense, that feeling that they must turn in a certain direction in order to follow the correct road. And we have seen how powerful this sense must be, how far superior it is to the faculty of smell, for when the ants have to choose between direction and scent, then direction easily wins.

This sense of direction seems most highly developed in those species of ants which frequent the trees. I have elsewhere shown its force in the case of the black ant, how it guides the workers in their ascents to the foliage and back again to the formicary on the ground. Its exceptional development in these arboreal species is most probably related to the widespread journeys which such ants have to make through the midst of the tree. They traverse each branch, investigate each twig, thoroughly search the whole canopy of foliage in their ceaseless explorations for food. In these complicated journeys they are always changing their direction, ascending one branch, descending another branch, now turning one way, now in an opposite way, always altering their line of progress, yet when it comes to making the return journey, they never lose the road. It seems a kind of feat of directive memory, yet how can they keep in mind each separate turn in the complexity of the ever-changing route. At least we can realize the value of the sense to ants with habits such as these. It is beyond our powers to feel its influence; we can only observe the manner of its work. Yet we can see its great power as a guide in the labyrinth, and must regard it as another of those feats of wonder performed by the hymenopteron brain.

The capacity to communicate the presence of danger is a common characteristic of a community of ants. In some species it is more highly developed than in others, and in the *Cecophylla* we observe it in a refined degree especially in regard to the defence of the nest. I have elsewhere supplied instances of its manner of occurrence and have shown how it takes place through the medium of the antennæ by virtue of the sense of touch. Alarm an ant in a *Messor* nest



and the following sequence occurs. The alarmed ant runs excitedly about; it meets a comrade, they touch antennæ, the second is imbued with the enthusiasm of the first, in the same way the information is transmitted to others, and soon the whole of the *Messor* nest is a bustling excited swarm. The point that deserves our attention here is that the information is transmitted from individual to individual through the medium of the sense of touch.

I think that it is otherwise with these arboreal ants and their far more spirited defence. There is no doubt as to their capacity to distribute information whenever a particular occasion requires. Anyone who has intruded too close to the nest will be satisfied with the truth of this. But the difference lies in the manner of communication, which takes place, I believe, in this arboreal species through the medium of the sense of sight. Alarm one of these *Ecophylla* workers. It does not, like the *Messor*, immediately run away in order to touch antennæ with the first comrade that it meets. On the contrary it more often fixes itself to one spot; there it remains on the alert watching for the slightest movement to occur. It assumes a characteristically expectant attitude. It stands still, raises its head, erects the fore part of its body, straightens out its long antennæ and holds them rigidly at full length. Then it throws itself into a quivering movement; it elevates its body in sudden jerks; it rapidly vibrates the points of its antennæ; it quickly raises and lowers its abdomen so as to give it a kind of instantaneous flick. The worker, in this way standing erect, makes its whole body as conspicuous as possible while it quivers with these sudden jerks.

Now what is the meaning and purpose of this? I think that the peculiar quivering motion is a signal to the other ants in the community that danger has arrived in the vicinity of the nest. These ants, as we have seen, possess excellent vision, and it is motion even more than the actual object which they can so readily detect. Therefore, when one ant elevates itself and throws its body into jerks, those in the vicinity see the movement and immediately vibrate in the same way. Others see them, and thus almost in a moment, as fast as the faculty of vision permits and far more rapidly than by tactile communication, the news of danger is widely spread. The whole community is quickly aroused and the army is ready for the attack.

I once had a nest under close observation; it had been broken from its place on the branches of the tree and its walls had become withered and dry. Nevertheless the ants still occupied the interior, and I noticed that, when they happened to be alarmed, a sharp and tapping noise was audible, a kind of hammering on the desiccated wall. On further investigation I came to the conclusion that this was a peculiar mode of communication by means of which the outside workers signalled to their comrades in the interior of the nest. We have seen their attitude in the face of danger, and how they raise and lower their abdomens so as to jerk them sharply in the air. It was by means of this sudden abdominal movement that the workers were able to produce the noise, for the abdomen, when it fell with a sudden jerk, often came in contact with the leaf and resulted in a sharp tap. It was a special device to permit of communication between opposite sides of the wall. When danger arrives in the vicinity of the formicary all the workers are on the alert. Those on the exterior are instantly aroused, since each can see the vibrations of the other and the information, as a consequence, can rapidly spread. But the main army is in reserve in the interior of the formicary; it cannot see the angry thrill, and, as a consequence, some special device is necessary to summon it from the leafy walls. The device is simple and highly efficient. The outside workers strike the wall with a sharp and sudden tap; the signal is received by those in the interior; they realize that danger of some kind approaches and the ferocious army comes pouring through the gate.

Can we reconcile this conclusion with the previous observations that the ants have no auditory sense? If they are unaffected by the report of a gun, how can they be sensitive to these gentle taps? It is not, I believe, that their hearing



is affected; they perceive the vibrations rather than the sound. It is their sense of touch which, in reality, is excited; they literally feel the delicate thrills which spread through the leafy wall.

Another point which I observed with respect to these ants was the fact that they establish a series of rest-camps at intervals along their line of march. Think for a moment on their industrious toil and we can scarcely deny them the necessity of rest. Consider their tireless and energetic nature, the burdens they carry, the victims they overcome, their ceaseless search for prey and provender, the impetuous manner in which they enter into battle, and their labour which never ceases day or night. These are examples of a busy life which must demand its periods of rest.

The ants gain some little repose from their labours as they journey from place to place. As a rule they do not halt in their onward progress while they traverse an unobstructed branch. Here and there one may turn from the main stream, moving to one side of the general current, and may there rest by itself for a little while and soon march on again. But the spot more usually chosen for their rest is the place where two branches join. Here, at the fork, they congregate in a body, often such a number at the same time, that I cannot but compare these selected places to rest-camps along their route. A few may collect where the smaller branches join, but it is usually at the junction of the main limbs that they establish the most populous camps. They choose such places for a special reason. If a number were to halt in the main road they would certainly impede the movement of the stream, but where the branches join there is more space available; there they can easily gather to one side without in any way obstructing the road. In a large camp there may be fifty or more workers collected, and at many of the junctions of the smaller branches three or four may be seen taking their rest. Most of them appear to be empty-handed, others are replete with juice. Occasionally one arrives with a larva as its burden or with a coccid fixed between its jaws. It is obvious that they are enjoying a well-needed rest. They remain quite stationary, fixed to the bark. Even the ceaseless tremblings of the antennæ have temporarily died away. Almost all of them hang with their heads turned downward, this being apparently the most restful attitude which these ants are able to assume. A halt for a minute or two seems to satisfy their needs. The encampment is in a state of continual change. Those which have rested are moving off and others are taking their place. What burden is equal to the labour of these ants? Their life is one of continuous effort, unceasing night and day. They have no relaxations as we understand them; the most they can hope for is an occasional rest in one of their established camps.

Lord Avebury, in his delightful record on ants, expresses surprise at the inability of these insects to make a short drop through the air in order to reach some object below. Thus in one instance they made a journey of nearly seven feet rather than drop only half an inch. At another time they abandoned their precious larvae, though if they had allowed themselves to fall three-tenths of an inch they could easily have gained their ends. But Lord Avebury's ants were inhabitants of the soil; he would have arrived at a different conclusion had he investigated these arboreal kinds. For they are so excellently adapted to a life amidst the branches that they are able in a highly efficient manner to make their way across an empty space. On an island standing in a basin of water I established a branch of a mango tree with one of these nests attached. It was a very vigorous and populous colony, and the ants every evening displayed great activity, spreading themselves over all parts of the branch. I imagined that the colony was safely marooned, that the ants could wander freely about their island, but could not manage to effect an escape unless they crossed the watery moat. But I did not realize the efficiency of the ants and their admirable powers of resource. On the second evening of their captivity they became very restless; they were clearly discontented with the closeness of their prison and wished to



spread themselves abroad. They repeatedly explored their narrow surroundings and thoroughly searched the whole of the branch in their efforts to effect an escape. Now, in one place a leaf happened to droop to within two inches of the ground. On this leaf a number of the workers had collected; the colony seemed to have concentrated on this most dependent point; it was obvious that they could see the ground beneath, and many of them stretched down from the apex of the leaf as if trying to reach their mark. I thought at first that they would surely allow themselves to drop, but, though many of them hung down by the mere tips of their legs, yet they would not risk a fall. They had at their disposal a more efficient method. One of them hung down to its full extent, clinging to the leaf with its hind claws. A second then climbed down along its body and thus almost doubled the length. Then a third and a fourth came down, and in this way the living line was elongated until it ultimately reached the ground. The ants had established a living ladder between the ground and the apex of the leaf. At this stage it was fragile and would not bear much strain, but other workers soon joined in it, linked themselves together, strengthened it round about on every side until it developed into a multiple chain. Nor must it be imagined that these ants were just thinking of themselves, that the second climbed down along the body of the first merely in order to reach the ground. This certainly was not the case. The workers that took part in the construction of the chain remained as permanent links. They never attempted to break from the machine or to escape themselves over the ground. They had linked themselves together so as to fashion a bridge which others in the community might use. These others availed themselves of the new construction. Those in the foliage soon discovered it, and a stream of workers was so quickly established that in ten minutes a hundred or more must have crossed it, and I lost nearly half the nest.

It would have pleased Lord Avebury to observe this incident. "In order to test their intelligence," he says, "it has always seemed to me that there was no better way than to ascertain some object which they would clearly desire, and then to interpose some obstacle which a little ingenuity would enable them to overcome." Is not this construction of the living bridge sufficient to satisfy Lord Avebury's demands? The ants desire to escape from their island. In order to do so they must surmount an obstacle; they must either cross over a sheet of water or descend through two inches of space. They select the latter as the easier feat, and the method they employ of surmounting the obstacle is the establishment of a living bridge.

Similar types of engineering workmanship are performed in their natural haunts. I have occasionally met with their construction in the trees. The chain as a rule is thrown vertically downward, but they will sometimes fashion a horizontal bridge so as to climb from leaf to leaf. Their chains may be as long as four or five inches. Some forty or fifty ants will then enter its construction, since they cannot merely link themselves in a single line, but must also mass themselves around the structure so as to give it the necessary strength.

That they are in the habit of thus bridging spaces in the foliage is made evident in another way. I removed a nest to a point lower down on the tree. Many of the workers soon deserted it and made their way up into the branches in order to get back to the original site. As soon as they reached the amputated stem their further progress was checked. It was amusing to watch their manner of behaviour, how they vainly attempted to construct a bridge in order to make a further advance. Many of the workers just stretched out from the stump. Another seized a comrade by the waist thrust it forward at full length, waved it in the air through the empty space, obviously in the hope of finding an attachment and thus laying the foundation of a living bridge. Of course in this instance the ants could not gain their ends for the nest had been completely cut away, but it showed how they instinctively build their bridges when they wish to cross the spaces in the leaves.

I observed another more delightful illustration of this kind. A stream of workers was moving through the foliage, passing and repassing in a double line which led from the collecting ground to the nest. At one place they had to negotiate a difficult situation; it was where the branches of two trees intermingled their foliage and caused irregular spaces in the vegetation through which the ants found it difficult to cross. At a certain point they encountered a serious obstacle. There was a wide gap between a leaf and a stem over which they were unable to pass. But a solitary worker had taken up a position and solely by the exertion of its individual efforts had managed to construct a bridge. With its jaws it had gripped the edge of the leaf; with its tarsi it had taken a hold on the stem, and the two were drawn close together by its exerting a continuous strain. In this way it fashioned an excellent bridge, partly by supplying its body as a road and partly by narrowing the gap.

Every minute hundreds of workers crossed and recrossed this simple bridge. They were all dependent on this solitary ant; if for a moment it relaxed its hold, then confusion would spread along their ranks. Nor did the single worker seek for assistance. Without aid, without relief, without a thought of relaxation, alone it had assumed this important duty and just clung with a rigid tenacity to its post. I have no idea how long it thus remained. I watched it in position for half an hour during which time many thousands of workers crossed it on their way from the leaf to the stem. It must have exerted itself to an extreme degree in order to continue so persistent a strain, yet it never for a moment made the slightest attempt to desert its self-established post.

I severed the bridge thus ingeniously formed, and restored the original gap. Consternation followed in the stream of workers, and a congested assemblage of helpless ants collected on the stem and leaf. But another worker soon came to the rescue and took the place of the one I had removed. It stretched itself across the gap in the same rigid way linking together the opposite sides, and thus replacing the original worker in the duty of constructing a bridge. Order and discipline then reappeared; the accumulation of workers soon dispersed and the even flow of labour was restored.

I know of no better example of individual co-operation in all the multifarious activities of ants. Here is a single worker lending itself to the advantage of the common weal. It is not merely an instinctive behaviour; it is an action employed in a special difficulty to meet a particular end. It indicates how the ants can divide their labour even to a refined degree. Moreover it displays a feeling of self-sacrifice, in that one will submit to tremendous effort in order to advance the well-being of all.

Here again we see the value of the attenuated structure so characteristic of this species of ant. Its elongated legs and extended body specially fit it for the construction of a bridge. Such must be the case in the simplest architecture and even more so in the manufacture of those complicated chains composed of a number of ants. We have already seen its value in the building of the nest, and it is also of use in the ejection of poison by permitting the ant to turn up its abdomen until the point is brought forward over the head. Thus the structure of the ant is eminently fitted for the duties of its daily life.

It would scarcely have been thought that these well-protected insects could have any very serious foes. They are able to attack in so fierce a manner and each is so well armed with a virulent poison that no ordinary enemy would dare to approach. And from the way they march in conspicuous files all over the branches of the trees it would seem as if they realized themselves that they had little danger to fear. I was, therefore, surprised to find in Mr. Mason's records that he had met with examples of the red ant in the stomachs of twenty-one species of birds. This is a powerful array of enemies. It includes the tit, babbler, drongo, shrike, oriole, myna, flycatcher, magpie-robin, ground-thrush,



sparrow, lark, woodpecker, roller, bee-eater, hoopoe, hawk, cuckoo, coucal, partridge and waterhen. When confronted with so formidable a list as this, how can we say that the *Ecophylla* is immune? Nevertheless it is only on the rarest occasions that we ever see them attacked by birds, and if they were really a tasty morsel they could never thus live exposed on the trees. We must remember that the red ant is easily identified, and, therefore, would seldom escape detection in the investigation of the debris from the stomach of a bird. I also calculate from Mr. Mason's records that, if the year be divided in half, more than three times as many ants were taken in the winter than during the summer months. This suggests that birds will have recourse to such food only when insects are scarce. The Golden-backed Woodpecker is their essential enemy and this might naturally have been expected for the bird lives largely on all kinds of ants. But few would have imagined that the Black Partridge ranked second in the number of their foes.

I have only casually referred to the state of the formicary at different seasons of the year. The community is active during winter and summer; unlike many ants there is no period of complete torpidity; even in the coldest months their columns may be seen ascending and descending the trees. In the cold season, however, they are distinctly more sluggish; the numbers that join in the streams are less, and there are fewer habitations to be found upon the trees. Yet even at this time the larvae exist; all through the cold months some are retained, and this must be essential to a community which depends on the special machinery of the larvae for keeping their chambers in efficient repair.

In March and April, as the warmth increases, the strength of the colony at the same time expands. The ants can now be seen at their various industries, capturing their victims, tending their cattle, bending and uniting the leaves. The area of the community also enlarges; it may send its columns across the soil to invade the neighbouring trees. The larvae in the nests are increasing in number, the cattle are becoming more abundant on the foliage, and the time has arrived for architectural work. In some places byres are under construction, in others they are being stocked with food, and the complicated machinery of architecture and provision is working at the highest pitch. Columns of ants are advancing along the branches; some are transporting the machinery for spinning, others are carrying cattle to the shed, others which support no obvious burden have their bellies distended with juice. It is a busy and energetic stream of workers that toils through these oppressive days.

This industry persists into the rainy season. It lasts until the sexual forms are reared and have abandoned the parent nest. Then the activity begins to decline. By August the armies have diminished in numbers. Here and there the files continue, but the multitude which overspread the foliage in June, has to a large extent melted away. Withered nests and deserted byres are now scattered about through the body of the tree; most of them are empty, having done their work, and the fresh leafy habitation, teeming with life, is now less commonly seen. The great business of the year has been satisfactorily performed. The broods have been reared, the queens despatched; hence the vigour of the commune now diminishes and the numerous chambers are no longer required. Sufficient workers will remain for the toil of winter. The community, though dwindled, will be kept intact for its reinvigoration in the succeeding year.

The sexual forms are not likely to be met with before the beginning of May. They are very different in appearance from the ordinary ants. The queen is immensely larger than the worker and is provided with extensive wings. Her usual colour is a vivid green which gives her a beautiful and striking appearance. It is from her that the species receives the name of the smaragdine or emerald ant. But the queens in this mango-grove were less handsomely adorned. They belonged to a variety with a yellowish dress. Some of them showed a faint tinge of green, but in the majority the colour was similar, though paler, to

that of the worker ants. It would be tedious to describe minutely the queen. I will draw attention merely to her massive size, to her stout and bulky quadrangular thorax, to her long satiny transparent wings elegantly patterned with veins. The male in his structure resembles the queen, and is furnished with the same type of wings. He is, however, distinctly darker in colour, being almost a uniform brown. He is also clothed in a garment of hairs of which the queen shows only the slightest trace, and in bulk he is, of course, considerably smaller, being less than that of a worker ant. These are the sexual members of the commune. There will be a number of each in every nest. The male is but an agent for the production of fertilization; the queen has within her the potential essence for the generation of a new swarm.

Most nests, if examined at the suitable season, will illustrate the mode of development of the queen. First, we will observe the royal larvae, stout, cylindrical, fleshy masses, slightly curved, with blunt extremities, and encircled with successive rings. They are enormous when compared with the worker larvae, appearing at least twenty times the size. Second, we will note the naked pupae, those in the early stages perfectly white, with all the parts well formed and distinct, the head bowed, the antennæ laid close along the middle of the chest, the legs bent neatly along the sides of the body, and the insect perfectly motionless and inert as though wrapped in a profound sleep. At a later stage we observe that the organs of vision appear as distinct points; the ocelli from a triangle of brown spots upon the vertex, and the eyes develop into oval discs on either side of the head. Still later we note that the body darkens so as to assume a pale yellow tint. A few fleeting signs of life appear; the quivering of the antennæ and the trembling of the limbs shows that the royal insect is waking from her sleep. Then the final stages follow. The wings, hitherto folded against the sides, are now drawn out of their delicate sheaths. They are trailed behind like gauzy streamers, limp and helpless without any strength, not yet being hardened by the roughness of exposure and still white with the tenderness of youth. This, however, is the final stage. It marks the awakening of the queen. She now moves feebly through the chambers of the nest. Her body expands, her limbs become more firm, vigour and rigidity come to her wings, her colour darkens to a yellowish red, black lines appear along the nervures of her wings and she develops her full muscular strength.

The larvae are fed by the worker ants during the period of their development in the nest. Indeed there is a special caste of workers associated with this business. They are distinctly smaller than the ordinary type; they do not engage in the general duties; they capture no insects, transport no loads, and are rarely seen in the streams of workers that journey everywhere along the branches of the trees. These diminutive workers are few in number. Their attention is given to the duties of the nursery, where they specially look to the welfare of the young. They act as nurses to the developing larvae, shifting them about from chamber to chamber, imbibing the fluid excreted by the cattle and ejecting it into the nursing's mouths. It is not that they alone tend the larvae; the ordinary workers too associate in the task. Also the smaller ones will enter into battle. Interfere with the habitation and they will join in its defence fighting with their diminutive jaws.

A remarkable peculiarity in the development of this ant is the fact that the larvae remain permanently naked; they never construct a silken case in which to rest during their pupal sleep. I have already described the appearance of these larvae when telling of their use in the architecture of the nest. At this period, however, they look almost structureless; later the external appendages develop and they become naked miniatures of the adult workers, perfect in all their parts. Each is pearly white in colour with the faintest yellowish tinge. There is a delicate translucency about its structure; we seem to see into the substance of the tender tissues, and cannot but admire its simple elegance and its



exquisite form and shape. It lies helplessly against the wall of the nest or hangs passive in its nurse's jaws. All its appendages are pressed close against its trunk so as to turn it into a fitting load. Its head is bowed and thrust in beneath its chest; its antennæ lie close along its ventral surface, and its slender legs, in parallel rows, are acutely bent and pressed tight along its sides. Thus it lies with no attempt at motion; to all appearances it is a dead thing. Yet this is but a passing phase; it is the wonderful trance of insect youth which will one day waken into life.

But its nakedness is the point of interest here. All its delicacy of structure is completely exposed; there is not a trace of an enclosing sheath. This is a most unusual occurrence amongst ants. The rule is for the larva to fashion a cocoon, a brownish bag of fine-spun silk which it wraps loosely about its body so as to invest itself on every side. Within this sac its development continues; there it changes from a structureless larva into the perfect form of the ant. All the steps in the metamorphosis are concealed owing to the enclosing sheath of silk. But it is otherwise in the case of the *Ecophylla*. Here all is naked and exposed to view; we can follow the wonderful unfolding process unobscured by a concealing veil.

It is natural to ask why the larvae of these ants do not sheath themselves in a pupal case. It is not through deficiency in the power of manufacture, for these larvae, as we have seen, are expert weavers, capable of constructing the silken fabric that enters into the walls and partitions of the nest. It might be thought that, since they expended so much in architecture, they had no more available for the construction of cocoons. But this can scarcely be a sufficient explanation, for there is a byre-building ant, the *Polyrhachis simplex*, of which the larvae both fashion their silk into cases and also weave it into the architecture of their nests.

I suspect that the explanation of the nakedness of the pupae is to be found in the nature of their arboreal life. The purpose, I take it, of a pupal case is to serve as a protection to the developing young. It is a loose impermeable sheath of silk which must shield the inmate from physical injuries, perhaps help to maintain a uniform temperature, and more especially protect it from damp. Ants seem particularly susceptible to moisture; if the nest of the *Ecophylla* becomes too dry, then the ants will transfer their larvae elsewhere; if the rain should permeate the tunnels of the *Polyrhachis*, then they will migrate to some drier abode. Now the nests which the red ants establish in the branches are infinitely less exposed to the effects of moisture than those which other species construct in the ground. The floods soon percolate into the soil, and the moisture, oozing through its porous substance, invades the galleries of an underground nest. In places it brings destruction to thousands of formicaries; it often compels incessant migrations; it forces a species, such as the *Polyrhachis*, to desert the dwelling dug in the soil and build a new one in the branches of the trees. But apart altogether from these serious inundations, the underground nest will be often in jeopardy. There must always be danger from occasional rainfalls; at some seasons the walls of the tunnels will be moist, at another crumbling and dry. Hence the larvae must be shielded from such variations; they must be swathed in an impermeable sheath if they are kept in an underground nest.

It is otherwise with the formicaries established in the foliage. The leaves, by their structure, are impermeable to moisture; the connecting fabric is of waterproof material, at least sufficient to keep out the rain. The only possible place where moisture can enter is through the narrow gateway of the nest. The larvae live in an impermeable chamber, and are consequently far better protected than if surrounded by the porous earth. They have, therefore, no need for individual encasements, and have abandoned the usual habit of sheltering themselves in the interior of cocoons.



We naturally seek for confirmation of this view. The *Polyrhachis* is the other important byre-builder, and we, therefore, expect to find naked larvae housed in its arboreal nests. But the larvae of the *Polyrhachis* are well sheathed in silk; each is completely hidden from view in a loosely crumpled bag. However, we must remember that for most of the year the *Polyrhachis* lives in an underground nest. It evacuates the soil only under stress of moisture, being but a temporary inhabitant of the trees. Moreover, its arboreal nest is not impermeable. It easily becomes waterlogged in heavy rain. The walls are composed of porous materials, particles of leaves, fragments of stems, often the soft seeds of grass. These result in a somewhat spongy collection which easily absorbs the rain. Thus the *Polyrhachis*, though it makes temporary arboreal habitations, has not lost the necessity of a pupal case. Its larvae are still subject to the effects of moisture, and thus differ from those of the red ants which live permanently in watertight nests.

Though the larvae of the red ants have lost the power of constructing individual cocoons, yet their silk-producing instinct has in no degree diminished; it is only applied to another use. It, no doubt, first originated for the ordinary purpose, each larvae using its own supply for the manufacture of a personal sheath. Later it was directed to more altruistic ends. The silk-producing machinery was not used for themselves; it was introduced as a part of the general architecture, and thus applied to the well-being of the whole nest.

The last point for consideration is of some practical interest. These ants have a certain economic value. Their columns, which so perpetually search the foliage, must in some way affect the existence of the tree. Arboreal mammals will be driven from the branches, birds will be prevented from nesting in the leaves. Insects of all kinds will be captured and destroyed; those special forms which serve the purpose of cattle, will, on the other hand, be carefully preserved. Some insects advantageous to the life of the tree, such as those of use for cross fertilization, may be prevented from fulfilling such ends. It is more likely, however, that injurious kinds are kept away by the swarms of ants. Leaf-eating insects and caterpillars and those which tunnel in the wood are sure to be captured when they invade the tree; coccids and membracids, which drain the sap from the shoots, are carried off and collected elsewhere. We know little of the complex chain in which so many lives are interlinked, but on the whole it would seem that the presence of the ants makes for the general advantage of the tree. It may be that both the ants and the tree are equally in each others debt, that the ants defend the tree from enemies and the tree supplies the ants with shelter and food.

Mr. Dutt has discussed this question in the agricultural memoirs, and he tells us there some interesting facts with regard to the relation of this ant to man. In Eastern Bengal and Assam the red ants are a pest. The mango-pickers cannot climb to collect their fruit and have to break it down with poles. But more extraordinary is the fact that people eat these ants. The Murries of Bastar in the Central Provinces are said to use them as a regular food. They collect the nests, shake out the contents, beat up the insects into a pulpy mass and then enclose them in a packet of leaves. Each of these packets, about the size of a goose-egg, is sold for one pice. The squashed ants are then prepared for food. They are mixed with salt, turmeric and chillies, again ground down with stones, and then eaten raw or with boiled rice. These facts are quoted by Mr. Dutt from a communication by Mr. Long. The eater is said to derive resistance against fatigue and endurance in the sun's heat. We may possibly doubt these supposed advantages, but, when we consider the amount of formic acid in these ants, we will certainly allow good gastric functions to those who can tolerate such corrosive food.

This concludes what I have to say on the subject of the red ants. If I have not wearied my readers with the long description, it will be due to the intrinsic

interest of the subject, to the multifarious activities of the busy commune and the wonderful instincts by which the ants are guided in the fulfilment of their essential ends. "Order is Heaven's first law." Such indeed do we see exemplified as we watch this ebb and flow of life. We have observed the order in relation to the seasons, the steady growth in activity and numbers, and then the subsequent decline. Each stream shows order in its methodical progress as it flows from branch to branch. Each load that is carried has a place in the operations; it is a capture on its way to be drained of fluid, a *Lecanium* about to be lodged in the enclosure, a larvæ brought along for the important business of securing the walls of a shed. Every bend in the stream is an ordered action, controlled by that wonderful directive sense through all the turns and complexities of the march. What order do we not see in the nest-construction, how all combine in a harmonious union, how the leaves are drawn together with a uniform tension, how in one place a worker will strain as an individual, in another place two or more will link themselves together, how all will maintain the leaves in position until the larvæ have completed their remarkable work. We see order and system in the taking of the prey, in the tenacity of the first worker that makes the capture, in the speed with which the reinforcements come to the rescue, and above all in the stubborn unyielding stretch. So also we observe it in their efficient transportation, and in their regular manner of securing cattle and of herding them within the sheds. How marvellously methodical is their system of bridges, either where one ant resigns itself to the general good, or where fifty workers link themselves together so as to construct a living rope. There is order in their repeated periods of rest. Though at first sight they seem engaged in ceaseless toil, yet on close examination we locate the rest-camps in which each ant takes its temporary rest. Even the defensive army, though it may appear like chaos, is governed by an ordered plan. It comes forth on the summons of the outside sentries, impetuously and ferociously engages the enemy, each ant prepared to render up its life in order to achieve the safety of the nest. There is no confusion in a colony of ants. Order and system is the guiding law. Each member of the commune has its allotted place and its duty in the daily toil.

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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA  
(INCLUDING THOSE MET WITH IN THE HILL STATIONS  
OF THE BOMBAY PRESIDENCY).

BY

T. R. BELL, C.I.E., I.F.S. (Retd.)

(Continued from page 717 of this Volume.)

PART XXXI.

Family—*HESPERIIDÆ*—continued.

Genus 7.—*SARANGESA*.

This genus is characterised as under in the *Lepidoptera Indica* Vol. X, p. 88:—

*Antennæ*.—Very slender, about two-thirds lengths of costa of fore wing; club moderate, slightly recurved.

*Palpi*.—Porrect, third joint short, bluntly conical.

*Hind tibiæ*.—With two pairs of spurs. In the male with tuft of hairs attached to proximal end.

*Fore wing*.—Vein 12 ends on costa a little before end of the cell; discocellulars suberect, the lower the longer; vein 3 from close below lower end of cell, 2 from about one-third from base; median vein slightly curved up between bases of 2 and 3. Cell less than two-thirds length of costa; costa gently arched with outer margin convex, shorter than the hinder margin as a rule (in *dan* it is equal to it); hinder margin straight.

*Hind wing*.—Discocellulars very faint, apparently in one quite straight line, of about equal length; vein 3 from very close to lower end of cell, 2 from a little beyond the middle; costa slightly arched, apex rounded, outer margin somewhat sinuous; wing about as broad as long.

*Egg*.—Dome-shaped, the height about two-thirds the breadth, very slightly constricted at the base, the top very slightly depressed; green or yellowish in colour; shining, the surface sculptured by 14 or 15 meridional ribs that are somewhat coarse, minutely beaded.

*Larva*.—Spindle-shaped, fattest in the middle, somewhat narrowed in the anal end, broader in the fore end where the neck is narrow compared to the somewhat bullet-shaped, bilobed, dark-brown head with a rugose surface. The surface of the larva covered with tiny feathered hairs only visible under a lens. The colour olive-green of a darkish shade, sometimes brownish with always a white collar consisting of nearly the whole of segment 2.

*Pupa*.—Not very stout, fattest in middle, pointed at anal end, rather broad and square in front, the frons convex but not actually beaked; with a triangular cremaster, prominent spiracular expansions to segment 2 and the proboscis produced free beyond the ends of wings. The colour green or yellowish brown with a greyish "bloom" caused by a copious clothing of minute, erect hairs all over the body.

*Habits*.—The eggs are laid on the top or underside of a leaf, on a leaf-bud or stalk. The larva makes a cell by turning over a small portion from the edge on to the top, the shape of this "lid" being triangular; it is fixed lightly down and coated on the inside or underside with a carpet of white silks upon which the larva lies with its back towards the main leaf-surface, its head turned round on its side. Later on it continues this mode of living but, often, makes a cell out of a hanging or caught up withered leaf with no particular



shape. The pupation takes place in such a cell as a very general rule. The pupa is attached by the tail strongly. The butterfly flies near the earth, is active, quick, resting on the upper surface of leaves, close to the ground; flies strongly but not for any length of time at a flight, returning to the same perch again and again; basks with the wings horizontally outspread in the sun, sometimes even on the bare ground or on a stone and generally rests in that position, although at night it sits on the underside of leaves but always keeping the wings spread. The larva feed upon dicotyledonous plants of the families *Acanthaceæ* and *Amarantaceæ*.

**207. *Sarangesa dan*, (Fabricius).—Male.** *Upperside*.—Rufous-brown. Fore wing, with three small, semihyaline, subapical dots from near costa in interspaces 6, 7, 8, the middle one the smallest and most innermost; in some specimens one or both the lower absent; a large semihyaline spot in end of cell, its inner side straight, its outer side deeply excavated and sometimes this excavation dividing it into two, of which then the upper is only half the length of the lower which is elongated; a small spot between this cell-spot and costa; a small square or round spot near base of interspace 3; a much larger one inside this last in interspace 2 touching it with its outer, upper side; and a minute spot, sometimes two below them in interspace 1, one above the other; all these spots slightly tinged with ochreous, brilliantly golden-ochreous in one incidence of light, all varying much in size in different examples; some brownish, indistinct marks on the wing decipherable as a subbasal transverse band, a post discal band highly excurved towards apex with the subapical dots on its upper part and a submarginal band; base of wing with ochreous hairs; the inner margin with a short fringe of similar hairs. Hind wing with a basal, indistinct brown transverse band; a subbasal similar band including a spot in cell; a medial curved similar one con-joining the subbasal at costa and a very slight marginal brown one. Cilia of both wings brown, those of the hind wing chequered faintly in some specimens; the fore wing with a light area just above tornus. *Underside*.—Like the upperside but duller; both wings with the markings of the upperside. The hind wing has a clothing of long, ochreous hairs from base outwards, reaching the outer margin on hinder half of wing and the abdominal margin has a fringe of shorter ones. *Female*.—Similar to male but with the hyaline spots, on the whole, always smaller, and always silvery-looking. Antennæ with the shaft brown, ochreous above, clearer ochreous below the club; club black, the upperside greyish; palpi light-ochreous above and below as well as the head and the underside of body; the legs have the tarsi with pinkish tinge. The tuft on hind legs of male is more orange.

*Larva*.—The larva is in shape a fat one, fining towards both ends which are comparatively narrow; the anal flap is semielliptical, slightly longer than a semicircle, sloping at an angle of  $30^{\circ}$ ; segment 13 a little broader rather than one-third its length in the middle, for this 13th segment is curved convexly backwards, being thus broadest in the dorsal line; segment 12 broader again than this latter and only a little more than twice the length in dorsal line; segment 11 twice the length of segment 12 and again slightly broader than it. The body comes to a distinct neck at front margin of segment 2 and the head is, as usual with skippers, a large one compared to this neck; the legs are all well tucked under the body; the whole larva generally sits humped up in the middle with its head turned round on its side. The head is perfectly heart-shaped, the dorsal line being considerably depressed below the rounded lobe-summits though not broadly, less depressed of course down the face; the clypeus is triangular

and not small, also depressed ; the surface is very rugose in irregular raised longitudinal broken, uneven lines and is clothed with silky appressed hairs though not very densely ; the surface is shining ; the labrum and ligula are, like the whole head, dark chocolate or brown, the eyes, jaws and antennal second joint the same, the basal joint also. The *spiracles* are very broadly oval, nearly round, whitish in colour, small, those of segments 11,12 slightly larger, that of segment 2 the largest. The *surface* of the body is covered all over with minute, short hairs to the extent of about 4 or 5 to the linear millimetre, each with a thickened, rounded top, those round the margin of the anal flap being comparatively long ; each hair rising from a little white dot : they are white themselves, these hairs ; there is a longer, simple hair sticking out backwards from the edge of the anal flap-margin in the lateral region on each side ; the prolegs, claspers and true legs have also longer, simple hairs on them. The *colour* of the larva is, when full grown, olive-green with an indigo-coloured, narrow, dorsal, pulsating line or band ; the front half of segment 2 whitish and shining. In the earlier stages the tint is much browner, approaching in some cases rusty, the white colour very conspicuous then. L: 20 mm. ; B: 4·5 mm. at middle ; half that at segment 13. There is an indistinct lateral and spiracular white line, very thin and inconspicuous.

*Pupa*.—The chrysalis is light green, slightly covered with a white “bloom,” covered with fine, more or less erect, fairly densely arranged hairs with shortly curved points except on wings ; stout, with a humped thorax and spiracles of segment 2 with a semicircular, prominent small, furred, chocolate-coloured expansion behind each. It is of the ordinary *shape*, that is of transverse circular section, slightly constricted somewhat shallowly and broadly laterally at middle, more conspicuously dorsally because of the humped thorax ; the cremaster has a very short and transverse base, the suspensory portion oblong, somewhat bend down, the suspensory hooklets arranged along truncated extremity, the whole member rather stout, the edges or margins thickened leaving the dorsal line broadly depressed, ventral extensor ridges slight and produced forwards, at first diverging, then curving round towards each other but not meeting ; segment 13 transverse, half the length of the whole cremastral segment ; 12 somewhat longer than 13, though not much ; 11 than 12. *Head* rather small, bowed, the frons prominently convex between the prominent eyes, in a plane perpendicular to the longitudinal axis of pupa ; the vertex nearly square between the bases of antennæ, in a plane at an angle of 30° to that axis ; the eyes bulging, longer than broad with a depressed, broad, shining, smooth band across middle perpendicular to the length of eye. Segment 2 about the same length as head-vertex and, like it, somewhat convex dorsally (in sense of length) ; thorax at first ascending from segment 2 in the same plane, then curving broadly up to apex and down again to hinder margin, the apical point being about two-third its whole length from front margin ; its hinder margin elliptically curved towards segment 4, meeting the wing-margins in a very broadly-curved, open angle of about 90° ; segment 4, therefore, long laterally, half the length in dorsal line ; abdominal dorsal line straight thence to segment 12 ; ventral line slightly convex in extreme half of wings then gently curved to cremaster ; the proboscis produced free beyond ends of wings to hinder margin of segment 9, the pupal surface somewhat depressed to receive it. *Spiracles* of segment 2 indicated by a linear, short, brown line on common margin of segments 2 and 3, with a semicircular (slightly higher however than broad) lappet or expansion behind it and immediately contiguous to it and perpendicular to the pupal surface, thickest at base, facing forwards, the surface of this little body being silky-plush-like and deep chocolate in colour ; the other spiracles of ordinary size, broadly oval, slightly raised, brown. The *surface* of pupa is shining, though not excessively so, the wings have the veins thinly (gradually) raised, the whole surface



with the exception of these wings and a fairly broad hinder (bevilled) margin to segments 8-10 and front margin to segments 9-11 covered with the fine, erect straight hairs with little curved tips mentioned above, like a sort of down, that on dorsum being perhaps slightly inclined backwards, that on head, eyes (with the exception of the band across them which is smooth) being longer than rest slightly, each hair-proceeding from a tiny brown spot. Colour green with a white "bloom" dotted with brown. L: 16 mm.; B: slightly over 4mm. at middle.

*Habits.*—The young larva cuts a piece out of the centre of a leaf, either young or mature, turns it over on to the top—it is often triangular in shape—and fixes it down with silks all round, leaving an opening for emergence and entrance; it coats this piece with silk and lives upside-down on the piece; lying always humped and contracted with its head turned round on its side it is always sluggish. Afterwards, in the second stage, it turns over a larger piece; after that it lives in folded leaves which wither, and it attaches them to the plant to prevent them falling to the ground. It pupates in such leaves which it does not cover with silk inside to any extent. The pupa is attached strongly by the tail and by a rather loose body-band which in its turn is fastened by the middle by a silk to the top of the cell, the body band being fastened to the sides, one on each side of the pupa. The pupa moves lazily from side to side when disturbed, the motion being from the segment margins, or in the intersegmental membranes of segments 8, 9; 9, 10 and 10, 11. A lot of larvæ were obtained in the Chandwadi evergreen, in North Kanara and round it at Christmas, in the Supa Petha, at 1,500' elevation. The butterfly is not uncommon in the District above Ghats and frequents the big jungles where there is a heavy monsoon rainfall and where the ground-vegetation practically never dries up. It keeps altogether to the underwood where it may be seen on leaves close to the ground, its wings outstretched horizontally, basking in the sun-patches that come through the overhead leaf-canopy. It rests generally on the undersides of leaves and is not commonly to be seen although the larvæ are plentiful enough. The flight is very similar to that of the insects *Sarangesa dasahara* and *purendra*; the larva is also extremely like those of that genus. All the specimens of the imago that occur in Kanara District in Bombay are golden-brown in colour and much brighter than those figured by Colonel Swinhoe in *Lepidoptera Indica*, vol. x, pl. 773, figs 2 to 2d: the male, also, invariably has the larger hyaline spots on the fore wing. The foodplant of the larva is *amarantaceus* (of the family *Amarantaceæ*) and is known by the natives as Agadha. Its scientific name is *Achyranthes aspera* and it may be known by its very elongated spikes of small, sessile, hooked fruits that stick to the clothes as one walks through it—it is often gregarious; the flowers are very small and inconspicuous, the leaves rather large and obovate with soft pubescence. Colonel Swinhoe, in his book says "Habitat: Southern India, Burma, Siam,



Malay Peninsula. Distribution; the type came from Tranquebar in S. India; we took it at Mahableswar and in several parts of the Bombay District and we have it from Coorg, Ootacamund in the Nilgiris, Rangoon, the Meplay Valley and Siam; Distant records it from Perak, Manders from the Shan States, Elwes from the Karen Hills, Moulmein and Tenasserim, Watson from the Chin Hills, Moore from Mergui, Wood-Mason and de Nicéville from Cachar, Davidson, Bell and Aitken from Kanara, Evans from the Palni Hills and Fergusson from Travancore. We give figures of the two extreme forms; they may be seasonal but we have no evidence to prove it. Unfortunately Davidson, Bell and Aitken did not figure the larva and pupa." This omission has been remedied long ago but the figures have not been published; they are still waiting.

**208. *Sarangesa purendra*, (Moore).**—Pl. N. figs. 83 ♂, 83a ♀.—Male. *Upperside* dark vinaceous blackish-brown. Fore wing with three subapical dots of equal size in a curve from near costa, a bar across the cell near its end, its outer side deeply excavated; a small spot between it and costa; another immediately outside its lower end with a short linear spot below it; all whitish and semihyaline. Hind wing with a spot at end of cell with a discal and marginal band all very little darker than the ground colour and very indistinct. Cilia of both wings brown alternated with grey, touched with a little whitish above the tornal angle of fore wing. *Underside*:—Paler than the upperside with the markings similar; an additional, whitish, indistinct spot on the fore wing towards the base of the internominal interspace. Antennæ black with white dots on the shaft and a whitish streak on the underside below the club; palpi, head and body above blackish-brown; on the underside the palpi are grey; pectus and legs with grey hairs.—Female. *Upperside*.—Similar to the male, the semihyaline spots on the fore wing a little larger. *Underside*:—paler than in the male. Forewing with the whitish spots larger. Hind wing with a whitish spot at end of cell, a discal series of whitish, lunular spots and a few more indistinct whitish spots inside the wing. Expanse: 32mm. to 35mm. (Swinhoe. *Lepidoptera Indica*, vol. X, p. 89.)

It is probable that all the specimens from which Colonel Swinhoe described the species were caught insects and that none of them were bred. The following description is from a series of fifty bred specimens from Kanara:—

Male. Fore wing. *Upperside* with white, short, decumbent hairs sparsely disposed from base to middle of wing, stopping before the discal markings; the outer half beyond discal markings similarly clothed, sometimes more densely but always leaving a broad terminal border more or less without them; this white hair-scaling giving a distinct greyish look to the portions having it; the usual short fringe of brown-black hair along inner margin. Cilia brown broadly at ends of veins, leaving the intervals narrowly white sullied with brown; the cilia at apex and above tornal angle rather prominently white. There are the three semihyaline, subapical spots mentioned in Swinhoe's description above; the bar at end of cell which is, however, not excavated on the outside, sometimes shallowly and widely; the spot above the bar on costa; a spot below the bar in interspace 2 outside end of bar, about as broad as that bar and filling the whole breadth of interspace; a small spot outside the upper, outside corner of this last in interspace 3; besides: a small spot or dot, joined to the inside lower corner of the spot in interspace 2, in the upper part of interspace 1 with another dot inside and under in the lower part of the same interspace 1; often, also,

finally, another similar spot or dot inwards half way towards base of wing from this last and in the same interspace 1. All these spots and dots are shaded with black, discal markings on their inside borders, the subbasal spot (the last mentioned) on its outside edge, the subapical also on the outside. Beyond the grey hair-scaling the outer part of the wing is, as said above, broadly dark-blackish with pale dots showing through by transparency so to speak from the underside in a submarginal series in interspaces 1 (two in this) to 8 and even 9 (the 9 spot then above the top preapical series of three semihyaline white spots), those in interspace 1 quite marginal as also those in 2 and 3; those in 4 and 5 a little in from margin, those in 6, 7, 8 still further in; parallel to this submarginal series there is a faint postdiscal series of four of which two are in interspace 1 and one each in 2 and 3. All these submarginal and post discal spots are very faint but the submarginal ones of interspace 1 are generally a little clearer than the others as are also those in interspaces 4, 5 while the post discal dots are always blurred. The basal third of the cilia is always brown. Hind wing clothed sparsely with much longer white hairs, those in the inside area longest, standing away from the surface; the fringe along abdominal margin-edge short and brown with white tips. The wing is of the same ground colour exactly as the fore wing and has a subbasal series of three blackish, rather large, very indistinct spots of which the central one is in the cell, the top one in interspace 7, the bottom one in 1; a postmedial series of similar dark spots but rather elongated and quite complete; all the white spots of underside showing through obscurely-pale except the one in the middle of cell which is more or less distinct but small. Cilia exactly as on fore wing except that the white intervals are more extensive, their bases brown. *Underside* :—Much paler than the upperside, the black borders to the spots showing darker against the ground colour and slightly extended-suffused. Forewing with the subapical three dots confluent, the cell-bar confluent with the spot above it; all the other semihyaline white spots similar to those of the upperside; the four white spots in interspaces 1 (two in this), 2 and 3 of the postdiscal series blurred-white or yellowish but distinct; those of the submarginal series on the whole better defined also, those in interspace 1 and 4, 5 quite distinct but very small, white, the upper occasionally yellowish as are the apical ones of the series—the dots in interspaces 2, 3 are nearly absent or very feebly expressed in all cases; there is a white streak from the origin of vein 2 inwards along the vein to base of wing often reduced to a spot at end (below origin of vein 2); the internomedian interspace is very pale brown throughout; the base of wing with a clothing of sparse, longish decumbent white hairs and a few white scales. Hind wing of the same shade as fore wing with similar white hairs at base and white scales in posterior part as far as anal angle; with the following white or yellowish-white spots: a subbasal or antemedial series of three, one in interspace 7 one in the upper part of cell and an obscure one in interspace 1; a postmedial series in a curve parallel to outer margin, quite complete, the first or uppermost in interspace 7, one in each of the interspaces 6, 5, 4, 3, 2 and a pair in 1; between these two series there is a thin white bar on the discocellulars with a streak-spot beyond in interspaces 4 and 5 with a slight blurred spot above them in 6 and a series of three more below in interspaces 2 and 1; so that there is really a sequence of three transverse bands of spots; antemedial, medial and postmedial; there is always an attempt at a fourth series, marginal, also, but it is nearly always limited to two in interspace 1 and one in interspace 2; the margin thinly darker. The “streak-spots” are elongated spots in interspaces 4, 5, and, curiously enough, on the underside of the fore wing, the same interspaces are often whitish postmedially resembling two streaks corresponding to those on the hind wing. Antennæ the same colour as wings, ringed with white all up the shaft, the club black with the ventral side of its base extending a short way down shaft ochreous-whitish head, palpi, body concolorous with wings above; below the palpi, pectus or breast and abdomen are white. The long fringe—it is



hardly a tuft—on the tibia of the hind legs is light-ochreous in colour.--Female. Very like the male in colour but darker on the upperside, with a slight russet tinge on the underside. Markings identical; also antennæ, &c. Expanse: 30 mm.

*Egg*.—Dome-shaped, broadest just above the base, slightly flattened on top round the micropyle. Surface divided into sections by fifteen longitudinal ribs of 0.05 mm width and 0.03 in height, rounded, rough; none of these ridges reach further than the edge of the concave area surrounding the micropyle which is only very slightly depressed and is 0.1 mm in diameter, circular; every alternate rib finished well short of the others; besides this the surface is shining, cross-rayed between the ribs with little, parallel, equally-spaced lines which are 0.05 mm. apart and about 0.0125 mm. in width, very low; all these ribs and cross-rays become more or less obsolescent towards the base of the egg; the distance between the ribs at the broadest part is 0.1 mm and between the cross-rays of two adjacent ribs 0.175 mm. Colour is light-green when laid, turning red before the larva emerges; the ribs are all white, the cross-rays green like the ground-colour. B: 0.75 mm; H: 0.5 mm.

*Larva*.—The *shape* of the larva is that of a spindle, the transverse section of segments 2 to 12 is circular, the body is much fattest in the middle, the ventrum is, however, somewhat flattened, the ventral surface separated from the dorsal half-segments by a slight ridge or fold immediately below the spiracular line; the anal segment is rather long, in shape a parabola, the end rounded; segment 13 well-developed; segment 2 is rosey-whitish, shining, the front margin straight, as long as segment 3 but narrower; there is a distinct neck and the head is comparatively very large, round in shape with a distinct though narrow, shallow sinus on the vertex in dorsal line dividing it into two, well-defined broadly rounded (on the vertex of each) lobes, the surface shining, rugose and covered with minute, decumbent, fan-shaped bunches of short, translucent-white hairs, each fan being made up of five or six rays or hairs all pointing downwards; it is really broadly heart-shaped; the true clypeus is equilateral, triangular, the apex acute, the length about half the height of face, the sides slightly convex outwards; the false clypeus outside reaches three-quarters the height of the head, similarly triangular, a broad stripe rather difficult to make out; labrum transverse, shining red-brown, one-third the length of the true clypeus; ligula the same length as labrum, red-brown with a wide, frontal, triangular sinus or emargination set with a few stiff, short, rusty-red hairs on the edge; antennal basal joint blackish red-brown as also the second joint; mandibles dark red-brown broad, strong and with their cutting-edges obscurely toothed; the eyes are arranged numbers 1, 2 close together, 3 a little further apart, 4 still further away, 6 about as far from 4 as 4 is from 3, number 5 behind and somewhat nearer 6 than 4, forming a triangle with these two, numbers 1 to 6 in a slight curve convex forwards, all blackish; colour of head deep red-brown; the small fans are really cup-shaped bodies with thin, hair like rays from a small conical tubercle surmounted by a thin stem, about 0.05 mm in height or length, the fan 0.05 mm. in diameter, the space between two ray-ends being about 0.15 mm. all translucent-white; *surface* of body is minutely pitted and covered with small, short, transparent-looking star-topped hairs as above described; the segments all well-marked and thin, parallel, impressed lines transversely across body in front of the hinder margin of each segment, 3 or 4 to each, the free margin of anal segment set with some 8 or 10 longish, simple hairs as well as having some longer-stemmed (than the rest of the body) star-topped ones; bases of pro-legs and true legs also with fine, simple hairs. *Spiracles* oval, small but well defined slightly raised, yellow-brownish. *Colour* of body a dark, blackish olive-green with a dark, dorsal, pulsating line and a fine, rather faint, lateral longitudinal line; segment 2 rosey-whitish; ventrum a shade or two lighter. L: 21 mm.; B: 4.5 mm. at middle.



*Pupa*.—This is, in shape, like that of *Sarangesa dasaharu*: eyes prominent, square in front and broad, the frons of the head slightly “bossed” with a small, round, hemispherical swelling; the breadth of the pupa at the eyes is broader than that at the shoulders or, at any rate, quite as broad; the lateral outline behind the shoulder parallel-sided as far as ends of wings with a slight dorsal constriction at segment 5 and a slighter, longer, lateral one between those points; head bowed, the frons prominent strongly between the eyes, in a plane perpendicular to the longitudinal axis of the body; vertex inclined at an angle of  $30^{\circ}$  to that axis with the dorsal ascents of segment 2 and the front of thorax, the hinder margin straight, the length rather greater than that of segment 2; this latter segment a transverse piece with straight hinder margin, as long as segment 4; the thorax broadly humped, the apex close to the hinder margin, the same height more or less from about one-quarter behind front margin to one-quarter before the hinder margin, the falling to the slight constrictions, the hinder margin a short parabolic curve meeting the wing in an open, well-rounded angle of something under  $90^{\circ}$ ; segment 4 is one-fifth the length of thorax in the dorsal line; 5 slightly shorter; segment 6 quite twice as long as 4 (this segment has the hinder margin broadly curved backwards, that of segment 5 less curved); segment 6 has the hinder margin straight; the portions of segments 9, 10 not included in the bevelled margins are short, the bevelled margins are smooth; 11 behind the bevelled front margin is also short; 12 has the dorsal line inclined to the axis of pupa at an angle of about  $30^{\circ}$ ; 13 inclined at  $45^{\circ}$ ; segments 11, 12, 13 coequal in length but narrowing backwards of course; 14 is composed of an anterior, broad, triangular portion and a much narrower, oblong, equally long, terminal moiety. Surface covered with erect, fine, light hairs all over, the end-halves strongly curved but without branchings, about 0.2 mm. in length, some form minute, dark depressions or dots; the wings shining, the rest covered with a blue-glaucous “bloom”; proboscis free after ends of wings as far as segment 11, fore legs reaching one-third of length of wings towards their ends, mid legs about two-thirds, antennæ between the two; there are no signs of any inserted parts between the two halves of proboscis near base or between it and fore legs; the clypeus is small, diamond-shaped and longer than broad; the extensor ridges of cremaster ventrally meet forwards making a completely enclosed circular space round the scars of the claspers; the suspensory hooked shaftlets are bunched at extremity of cremaster and orange in colour, short; the segments are all well-marked and the wing-veins are obtusely prominent. *Spiracles* of segment 2 are very prominent semicircular processes, dark-brown and spongy-looking, facing forwards with a diameter quite as great as half the length of segment 2; the other spiracles are small, broadly oval, prominent, with central, depressed slits, soiled, dull orange in colour. The colour of the pupa is rather dark yellowish-brown with the bloom above mentioned; thorax and head darker. L: 14 mm.; B: somewhat over 4 mm.

*Habits*.—The eggs are laid singly anywhere on a leaf or leaf-stalk, the larva, emerging, immediately makes itself a house, turning over a triangular part of the leaf from the edge. It does not eat the shell of the egg and emerges through a hole towards the apex which it eats through from inside. Later on, as it grows larger it makes new cells which are always only lightly fixed down round the edges; in the last stage, when full-grown, it prefers making its home in the middle of two or three withered leaves which it binds together strongly with silks, often choosing a dead leaf and a couple of green ones; it pupates in this, fixing itself by the tail firmly and throwing a band round the body in the usual position; the inside of the cell or house is generally

lined thinly with web or silks. This skipper has the same habits exactly as *Sarangesa dasahara* frequenting similar places and flying in a similar manner, resting in the same positions and generally occurring in similar numbers together with that species. Many specimens were bred in the Kanara District in Bombay on species of *Asystasia* (*Acanthaceae*) both in the dry weather as well as in the monsoon. It is found there from sea level up to 2,000' in the Ghats.

This species is most similar to the *Sarangesa purendra* figured by Swinhoe in plate 778, figures 3, 3a and 3b in *Lepidoptera Indica*, volume X. Fresh specimens are, however, much blacker and the undersides of the hind wings are dotted with white more like his *S. sati* on the following plate. These butterflies (*Sarangesa dasahara* when fresh is just as black) fade very much with time and become earthen coloured. Swinhoe says *purendra* is a common species all over India; "Moore records it from Bombay, Umballa, Kasauli and Kangra; we took it at Bombay, Poona, Mhow, Karachi and Hyderabad, Sind; we have it also from Ranikhet, Dehra Dun, Pachmari and Karwar where Davidson, Bell and Aitken bred it; de Rhé-Philipe records it from Masuri, Betham from Matheran, Hannyngton from Kumaon, Doherty from Kunawar. It does not appear to extend into Burma or Ceylon." (Swinhoe, *Lepidoptera indica*, vol. x, p. 90).

The male and female butterflies are represented on plate N, figures 83 and 83a respectively. While the female is a good colour in the picture, the male is far too red although it has, in nature, a slight tint of the red in the brown, as compared to the female, on the underside. The actual insects from which the paintings were made were certainly not Kanara specimens and came most probably from the neighbourhood of Bombay or north of that.

**209. *Sarangesa dasahara*. (Moore).—Male. Upperside.**—Coloured like *S. purendra*, a little darker. Fore wing with three similar subapical dots; a small dot at the upper end of the cell with another above it; a very indistinct, discal band and a similar middle band both slightly darker than the ground colour. Hind wing with indications of a discal and marginal band. **Underside:**—Much paler, the bands consequently more pronounced, the hind wing with some grey suffusion between the band and along the abdominal area, caused by minute, greyish-white scaling. Cilia as in *S. purendra*.—**Female.** Similar to the male but, in the fore wing, there is an additional dot below the cell, all three being in a line and a dot in the interspace 3 a little before its middle. **Underside:**—Similarly marked, the coloration and bands as in the male. Expanse up to 35mm.

The above is Swinhoe's description. In *Lepidoptera Indica*, Vol. X, p. 90, he says that the types came from Bengal and that the species seems to be common all over India but, apparently, by his enumeration of localities from which he has seen specimens, he has not had it from anywhere in Peninsular India except Ganjam on the east coast and Travancore south of Bombay Presidency on the west coast. His above description is meagre and, judging by bred specimens of



which we have half a hundred available, based upon inadequate numbers. He has erected a species, the one following *S. dasahara* in the book, which he has named *S. davidsoni* from Mahableshwar and Karwar (this latter in Kanara) and gives descriptions of the larva, pupa and habits from "Davidson, Bell and Aitken in the Journal of the Bombay Natural History Society, Vol. XI, 1897, p. 34." Davidson, Bell and Aitken called it *S. dasahara* and it is difficult to say how the mistake arose, for mistake there certainly is. The insect that occurs in Kanara is certainly not *S. davidsoni*, Swinh. A description of it is as follows, taken from the fifty specimens; if it is not *S. dasahara*, then it must be a new species and *dasahara* does not exist in the District of Kanara.

**Male.** Fore wing. *Upperside*-Vinaceous—blackish-brown, certainly darker than in *S. purendra* because there are no grey hair-scales on either wing; they are replaced by much fewer yellow hair-scales on the fore wing and by brown hairs on the hind wing. Fore wing with the three subapical, semi-hyaline spots, two spots towards end of cell, the upper triangular, and sometimes joined to the lower by its lower angle, the two then forming one spot deeply excavated on the outer side; a somewhat smaller spot between these and the costa; a white, semihyaline dot towards the base of interspace 3 half way between the cell-spots and the subapical spots, on a level with the lower of the former; another in the middle of interspace 2 about half way between the cell spot and the one in 3; a transverse medial (or very nearly) band from inside the cell-spots to inner margin appearing somewhat macular and a similar transverse, postmedial band somewhat oblique, beginning rather broad inside the subapical spots, including the dots in interspaces 2 and 3, to inner margin before tornal angle, the inner margin in continuation and a marginal band up again to apex in further continuation, all darker than the ground colour; the interval between the postmedial and marginal bands often lighter than the ground colour because of ochreous scales; a fringe of short, dark hairs along inner margin. Hind wing with the following dark transverse bands: an ante-medial, much excurved one, consisting of a large spot in interspace 7, another at end of cell and filling it, a third in median interspace by abdominal fold; a postmedial series of spots beginning with one in interspace 7 below middle of costa, excurved in the middle of wing, with a spot in each interspace 6, 5, 4, 3, 2 and two spots in interspace 1, the band practically continuous and somewhat irregular—that is not always exactly symmetrical in two specimens; the abdominal margin fringed on its edge with white hairs. *Underside*: Paler on the fore wing with some ochreous hairs at base, the semihyaline, white spots as on upperside, the dark, transverse bands rather more obscure; with a pale streak from origin of vein 2 inwards under the vein to base. On the hind wing much paler ochreous-greyish because of a plentiful sprinkling of hairs and scales, omitting always the dark bands which, therefore, stand out much more boldly than on upperside; the costa narrowly with apex broadly dark. Cilia of fore wing brown practically with apex tipped white and interval between veins 1 and 2 above tornus also white-tipped; on the hind wing broadly yellowish-white with the bases brown.—**Female.** Like the male in every respect, perhaps a wee bit lighter in colour, the markings similar. Antennæ in both sexes concolorous with upperside of wings, ringed with white, the club black with the tip whitish below and the shaft also at its distal end; palpi ochraceous below as also the pectus, the third joint and upperside of palpi and the head concolorous with upperside of wings; body and abdomen also concolorous with upperside of wings above; below ochreous but with, in the male, grey

black hairs on the thorax; the legs brownish; the tuft of hairs on the hind tibia of male black amongst the ochreous fringe. Expanse: 30mm., the same for both sexes.

In small specimens the two cell-spots are well separated and the dots in interspaces 2 and 3 on the fore wing are entirely wanting both above and below. All these specimens, from which the above description is taken, unfortunately, were bred in the rains. In the dry weather, doubtless the colour would be lighter, possibly the spots smaller (or larger?) and some of them might possibly be wanting.

*Egg*.—The egg is in *shape* a dome, circular, the base as broad as the diameter further up the sides. The *surface* is shining, minutely tuberculate generally and sculptured by 14 meridional ridges of which 7 reach a flat, circular surface that forms the apex and is likewise tuberculate in the same way as the rest; these ridges coarse and high, 0.025 mm. in breadth by 0.05 mm. in height, separated by an interspace of 0.2 mm. in the middle of the sides of the egg; the surface is also cross-rayed by low, paralleled rays between these ridges in the top one-third, not cross-rayed on the rest of the surface; the ridges are all rough-tuberculate; the longer ridges are 0.15mm. longer than the shorter and, as a rule, between these; the flat—it is slightly concave—space on apex is between 0.1 and 0.075mm. in diameter. The colour of the egg is a soiled, light yellowish or extremely light brown all over. H. 0.9mm.; B. 0.65mm. with the meridional-prominence, the B. without them is 0.055mm.

*Larva*.—This is of exactly the same *shape* and type as the larva of *Coladenia dan*. The body is fattest in the middle, circular in transverse section from segment 2 to segment 12-end, the anal end rather fine, the neck or segment 2 about the same width as segment 11; segment 13 a transverse distinct piece little shorter in the dorsal line than segment 12 but having a curved hinder margin, convexly produced in a curve towards anal segment from the spiracular region on one side to the same on the other; the anal segment slightly narrower, as long as 13 and 12 together, consisting of a basal transverse, short piece with a semicircular longer piece in continuation, this semicircular piece convex transversely with four longish reddish hairs directed horizontally out backwards from its margin, one on each side dorsolateral, one spiracular, the hairs as long as segment 13; segment 11 one third as long again as segment 12; segment 10 longer still; the prolegs and true legs all short, the ventral surface flattened as usual so that the “transverse section” of the larva is not really circular as stated above—in larval descriptions we have generally called it so, however. *Head* as broad as segment 3 at front margin and as high, higher and broader than segment 2; more or less quadrate in shape though slightly broader above than at mouth, with a very gradual, shallow sinus on vertex leaving each lobe broadly rounded there; the surface is shining, rather coarsely cellular-rugose, the dividing lines or ridges rather broad, each depression between them set with a single, decumbent, longly feathered, white, shining hair which is about as long as the depression and the feathers about half as long in the middle of the hair, getting smaller towards the tip; the clypeus is triangular, equilateral about one-third the height of the face; the false clypeus about two-thirds the height of the face very broad, arc-shaped but longer than broad; the labrum is transverse, narrow, lightish; the ligula small; the antennal joint both dark-brown-reddish, the mandibles the same, the eyes black; a few longer hairs, simple, about mouth-opening. *Surface* of larva is dull, smooth, the skin thin, covered with minute, well-spaced, short, rather long-stemmed, star-topped hairs that are light in colour and have the rays of the stars consisting of many single hair-like processes; some of these hairs being surrounded by a whitish, slightly raised, circular, collapsed tubercle or something like it; those on the extreme segments 13, 14 form redbrown, lowly conical, shining tubercles—few, funny looking, oval, larger, very lowly-convex, glassy tubercles surrounded



by a thin line on segment 14 where the hairs are all longer than anywhere else and where, also, there are 4 much longer hairs pointing backwards—as mentioned already above; the segments well marked with the usual impressed lines, parallel, in front of hinder margin. *Spiracles* small, oval, nearly flush, whitish; those of segments 2 and 12 larger. *Colour* of the larva is brownish olive-green with a spiracular, white, thin, somewhat interrupted line and a dark, sometimes interrupted, dorsal line; the paired bodies between segments 9, 10 yellowish, large (in the male); the anal segment yellowish, the segments 3, 4 pinkish headed; segment 2 nearly white; the sides of the body from spiracular line down lighter as well as the ventrum and legs. L. 20mm.; B. 4mm.

*Pupa*.—This is a normally shaped chrysalis, fattest in the middle, blunt and square in front, pointed behind, the head with the frons in a plane perpendicular to the longitudinal axis of body, the vertex in the same plane as segment 2 and the front slope of the thorax about  $30^{\circ}$  to that axis or slightly over, the frons rather prominently convex between the eyes, the eyes prominent rounded, the whole piece, including segment 2, quadrate, somewhat constricted behind the eyes, the margins of head and segment 2 straight; the thorax humped and broadly convex about  $4\times$  the length of segment 2, the apex about half way between front and hinder margin, the dorsal line sloping with segment 4 to segment 5 at a gentle angle; the pupa constricted shallowly and rather conspicuously dorsally and laterally behind thorax the hinder margin of which is a semicircle curve, slightly produced (though not in the least angled) in dorsal line, meeting the wings in a widely rounded, deep angle of about  $60^{\circ}$ , this angle limiting the somewhat convex lateral portions of segment 4 laterally and anteriorly; segment 4 as long as segment 2 in the dorsal line; segment 5 rather shorter than 4 if anything, segment 6 twice as long; segment 12 about as long as segment 2; segment 13 little shorter; segment 11 about equal 12; the cremastral (anal segment) a thick triangular piece, the sides concave, the end shortly square, the whole segment  $2\times$  the length of 13, bent down rather strongly, the end set with short, dark-rusty, hooked shaftlets, the hinder margin with a central, quite large, semicircular depression that has its reproduction, though slighter, on the hinder margin of segment 13; the dorsal outline behind thorax straight as far as segment 9, then sloping to anal end; the ventral line straight to near the cremaster then bent down; the abdomen fattest in the middle of pupa again after the constriction behind the thorax. *Surface* not particularly shining except on thorax, wings and head with segment 2 covered all over with a fairly dense coating of half-erect, very fine, whitish hairs that are as long as segment 13 is long or somewhat less, except on wings and segmental membranes; the bevilled edges of segments 8-11 sloping, the anterior (segment 9-11) rather steeply, the posterior (segments 8-10) gradually, the former more roughly granulated than the latter though both are very finely so and all are delimited by a rather prominent angle from the rest of the surface; the venation of the wing well-expressed; the proboscis produced free beyond the wings to end of segment 12; the hairs on the head are also well developed, those on the eyes being particularly long. *Spiracles* of segment 2 indicated by a broadly semielliptical, convex, dark red-brown, rugose surface with its base on the front margin of segment 3 and lying on the surface of that segment, facing slightly obliquely up and forwards, about as long as half the length of segment 2—not quite; the rest of the spiracles broadly oval, red-brown in colour, very prominent, broadly truncated cones, of moderate size. *Colour* bright emerald-green toned down to glaucous by the clothing of hairs except on thorax, wings, and segments 1, 2; the wings whiter as well as the cremaster. L. 14mm.; B. 4mm.; H. 4mm.

*Habits*.—The egg, always single, is laid anywhere on the leaf or the leaf stalk. The young larva, when it first emerges, proceeds to the edge of the leaf where it turns over a small, triangular portion of

the leaf on to the top, coating the piece thus turned over with a lax cloth of silk and fastening it down all round by a few strings or threads. It lives on the underside of this piece, lying with its head turned round on its side like the rest of the *Sarangesa* and *Coladenia* tribe that we are acquainted with. In all future stages this position of rest is adhered to. After the second moult it folds a leaf by drawing the two edges together with web, often using withered leaves for the purpose; sometimes, more rarely, even a leaf of another plant that may happen to be lying about or against the foodplant. It is always sluggish in its movements and dislikes the light at all times. The pupa is formed in a roomy cell, coated with silk, made of withered leaves of the foodplant or any other shrub or weed; and is attached by the tail with a loose body-band that is generally attached by an anchoring-thread to the roof of the cell as described for *Badamia exclamationis*. The foodplant is acanthaceous and may be either *Asystasia* or *Blepharis asperima*, both low, more or less herbaceous, weeds that are common in the jungles and regions of heavy to moderate rainfall from sea-level up to some thousands of feet. The butterfly flies low down amongst the bushes and grasses with a fairly fast, jerky flight and devious path; it settles with the wings spread out horizontally at all times and may be met with at all times of the year but is, of course, most plentiful towards the end of the monsoon in Bombay; it visits flowers frequently but never rises to any height above the ground.

#### Genus 8.—TAPENA.

Colonel Swinhoe gives the following:—

*Antennæ*.—The club moderately fine, well-hooked, often very much hooked the tip acuminate.

*Palpi*.—Prorect, third joint short and obtusely conical.

*Hind tibiae*.—With two pairs of spurs, the male with a long tuft of blackish hair lying along its inner side.

*Forewing*.—Vein 12 ends on costa before end of cell; discocellulars sub-erect, the lower the longer; vein 3 emitted about one-sixth before lower end of cell, 2 one-fourth from the base, cell a little less than two-thirds length of costa, the costa evenly arched, apex acute, outer margin straight to vein 2 and inwardly oblique and slightly concave to tornal angle, hinder margin of similar length, nearly straight; some brown hairs at base—very few—and a short fringe along inner margin.

*Hind wing*.—Vein 7 from a little before upper end of cell; discocellulars and vein 5 faint, the lower discocellular the longer; vein 3 from close to lower end of cell, vein 2 from very little inwards; costa highly arched in the middle, apex angular, outer margin sinuate and somewhat produced and angled at the end of vein 3, slightly concave above the angling, the wing somewhat square in shape; the base with longish, brown hairs as far out as middle of disc, with much longer hairs reaching little short of termen on hinder half, the abdominal margin with a thin, short fringe of brown hairs. Cilia concolorous with the wings.

Concerning egg, larva, pupa and habits see below. There is only a single species *à propos* of which Colonel Swinhoe notes: Elwes and



Edwardes have erected two species on account of some differences in the genitalia. They were not able to examine the genitalia of any Ceylon specimens, therefore cannot say how they differ from Burmese and Nilgiri examples. We have examined this species from different localities; we find that the size and shade of colour varies much in examples from the same locality and, for purposes of this work, it is impossible to recognise species that can only be differentiated by the examination of the genitalia of such male specimens. (*Lepidoptera Indica*, Vol. X, p. 60.)

**210. *Tapena thwaitesi*, Moore.**—Male. *Upperside*:—Dark-brown with a purplish tint. Fore wing. With two subapical, semihyaline, white dots near the costa and, sometimes, a very minute dot below them; an indistinct, discal fascia a little darker than the ground colour of the wing. The species varies in the shade of colour; in some examples it is much paler and more brown than in others, showing the fascia more plainly. Hind wing. Also with discal fascia, not visible in the darker specimens; a white semihyaline dot at end of cell, sometimes absent. *Underside* ♂—Similar but paler. Cilia concolorous with the wings. Antennæ with the upper half of club dull-ochreous on the underside and a whitish streak below on shaft, the two sometimes one, the upperside pinkish; palpi brown above, ochreous below; head, body above and below and the legs concolorous with the wings. Female.—*Upperside*:—Paler with an ochreous tint. Fore wing. With three subapical spots, more linear and larger than in the male; a larger spot at the end of the cell with its inner margin extending upwards and with a dot between the extension and the costa; a spot below it in interspace 2 rather larger and a dot outside at the base of interspace 3 between the large spots. Hind wing. With a prominent white spot at the end of the cell. *Underside* ♀—Similar. Antennæ as in the male; a white spot on each side of the collar; palpi greyish-white, with short, brown hairs and a white patch on each side below the eyes. Expanse: 40mm. to 45mm.

The Kanara specimens are uniformly smaller, never over 35mm. in expanse. In the fore wing the dark fascia deciphers into a black spot towards base of cell, another outward in base of interspace 2 with a black mark across interspace 1 below it a little inward; the large semihyaline two spots with black inside edges continued as two dark spots to inner margin; their outer borders also blackish-suffused, connected by blackish suffusion with the black-bordered subapical dots; a submarginal black-suffusion forming a band but interrupted broadly in the middle; in very dark, fresh specimens the whole of the outer disc from end of cell to this last submarginal band is suffused blackish. In the hind wing the markings decipher into a subbasal band, a medial band through end of cell and a postmedial band of spotted appearance with the terminal margin darker also than the general colour. The tarsi of all legs are golden-ochreous; the palpi dull-ochreous in the male, ochreous-grey in the female.

*Egg*.—The general *shape* is that of a dome with 13 or 14 meridional, sharply-defined, tuberculate, white ribs or ridges on the *surface* which are more or less broken at about one-quarter their length from the apex—some 7 or 8 that is ~~thus~~ broken, the other 6 or 7 continue up to the flat, apical, 7 or 8 sided area, the ridges coming in at the angles; this flat space, and for some distance outside it, is punctuated by little raised, white dots (shortened lines): the flat area itself is bounded by a darker shade than the rest of the egg and has a central, white dot on it (the micropyle probably) and is about one-sixth of the whole diameter of egg in width; the surface between the ridges is nearly obscured by many tiny, very short, white, hair-fine, longitudinal, raised lines, about 9 parallel to each other between every two ribs near the top of the egg, just below the “lid,” which lid is that portion of the egg above the break in the meridional



ribs—the interspaces between these tiny lines are broader than the lines themselves; hardly shining. *Colour* is green. B. 0·75mm. H. 0·50mm.

*Larva*.—The *shape* of this larva is nearly perfectly spindle-shaped; the transverse section circular—except that, as usual, it is somewhat flattened on ventrum—with the anal end narrowly square; the 2nd segment just a trifle broader than the anal extremity, and much narrower than the head which is as broad and high as segment 3 at front margin; segment 13 is half the length of segment 12, a well-defined, transverse piece; the anal segment after it is a perfect trapeze with the extremity about half the width of the anterior margin, the whole segment convex transversely, sloping at about  $30^{\circ}$  to the longitudinal axis dorsally, overhanging the anal claspers and low on the resting surface; segment 13 has the same dorsal slope; segment 12 is over three-quarters the length of 11; all prolegs and legs are small, short; the body is slightly flanged along the dorsoventral line and is by far fatter in middle than anywhere else. The *head* is large and exceptionally flat, hardly convex on face, very broadly heart-shaped, broader than high, nearly straight across the vertex except for the very slight, shallow, central sinus; surface reticulated all over with comparatively broad, flattened, shining lines, the cells or interspaces being dull, greyish and, of course depressed between the lines; the clypeus is triangular, apex acute, about one-third the height of face; the false clypeus moderately broad outside it from just below the middle, a band with convexly curved (outwards) margins, apex acute, reaching half the height of the face, the surface also reticulated; labrum transverse, rather short, light in colour; ligula broadly kidney-shaped, rusty with darker ends to the broad, deep, frontal sinus; antennal, basal joint light as also the second; mandibles large, strong, broad, light-orange, the ends dark and quite entire (without teeth); the eyes arranged rather abnormally: numbers 2, 3, 4, 6 in a quite straight line, number 1 a little behind, 1 to 4 all equispaced, rather close together, number 6 twice the distance from 4 and number 5 behind 4, on a level with it and further away from it than 4 from 3 for example, all dark coloured; the colour of the whole head soiled orange with a moderately broad, marginal, dark-brown band from the eye-circle up each side and over the vertex, another, less broad, behind limiting the foramen or where the body fits into the head. *Surface* dull and quite destitute of hairs of any description, the segments well marked and the few impressed lines in front of hinder margins punctuate occasionally dorsally. The *spiracles* extremely small, in depressions; those of segments 2, 12 larger; all whitish and broadly oval. *Colour* of the whole larva chalky-white with a slightly bluish shade, opaque, the segment-margins and impressed lines showing thinly dark. L. 24mm. at the most when stretched, and B. 4mm. and slightly over at middle.

*Pupa*.—The general *aspect* is stout, the anal end pointed, the thorax humped, the head-piece, consisting of segments 1 and 2, quadrate, the vertex of head with segment 2 and the front slope of thorax in a plane at about  $30^{\circ}$  to the longitudinal axis of the pupa; the frons in a plane at right angles to that axis, produced out into a porrect, slightly upturned, conical, rugose-surfaced beak which is as long as the head-vertex; segment 2 a transverse piece not as long as the head and with the front and hinder margins quite straight, parallel to each other; shoulders somewhat prominent but evenly rounded, the dorsal outline of thorax convex, gradually rising from front margin to about one-quarter before hinder margin, then descending to segment 5, including segment 4 in the gradual descent; the hinder margin of thorax a short parabolic curve meeting the wing-lines in a broadly rounded, deepish angle of something over  $45^{\circ}$ ; segment 4 dorsally slightly longer than 5; segment 5 about half segment 6; pupa broadest at middle but very nearly the same breadth there as at shoulders, highest at thoracic apex; dorsal line of abdomen straight, ventral line slightly convex; segment 13 a transverse piece disappearing on the sides of the pupa, convex longitudinally, shorter than segment 12; segments 11, 10, 9 also



about equalling 12; segment 14 with a short, truncate-conical basal portion produced into an equally long, nearly perfectly oblong cremaster with tiny hooked shaftlets as its extremity, the whole segment equal  $13 + 12$  in length; both 12 and 13 with a slight sinus in the dorsal line on their hinder margins; proboscis reaches just to the ends of wings; the antennæ about three-quarters the way; the cremaster is only very slightly bent down. *Surface* shining, thinly transversely aciculate all over except on wings which might be said to be minutely granulate; the segments all well marked; the bevelled edges of segments 8-11 hardly existing on hinder margins of 8-10, sloping and quite well developed on the front margins of 9-11; both margins of segment 13 rather suddenly raised from 12 and 14, hinder margin of thorax rather suddenly higher also than the adjacent surface. *Spiracles* of segment 2 are slits, linear, between segment margins 2, 3 bordered by dull-white, broadish bands on each side which are differentiated from the surrounding surface only by being dull instead of shining, about as long as segment 2 or only slightly less; the rest of the spiracles small, oval, dull, opaque white. *Colour* waxy looking white with a translucent greenish tinge on wings, thorax and head; the only colour about being the reddish cremastral hooked shaftlets. L. 18 mm.; B. 4.5mm.

*Habits*.—The eggs are laid singly on the young shoots; the egg larva after emerging turns over a long section of the edge on to the top, parallel to the midrib, the section adhering, by a narrow stalk left at its middle, to the leaf; the larva lives upside down on this turned-over piece coating it with silk. When full grown it places one leaflet over another nibbling pieces out of the edge all round. The change to pupa takes place in such a cell and the chrysalis is attached by the tail and a body-band inside. The cell is always rather laxly lined inside with silk. The larva is sluggish and does not like the light and lies in its cell with the head turned round on the side as often as not. The places chosen for oviposition are generally shady, out of the sun and the leaf is always a young one. The larva lives on young or youngish leaves at all times. Often there are many eggs laid on a single tree or bush and banks and the sides of nallas are favourite places. The imago is a strong flier, rises at times high up in the air, is moderately fond of flowers and has a jerky, devious flight. At all times it rests with the wings horizontally extended, always slightly bent down at the ends. The foodplants are *Dalbergia latifolia*, the Rosewood or Blackwood or Shisam found all over Western India, *Dalbergia tamarindifolia* and *rubiginosa*, both large climbers of the Western Ghats. Sumatra, Borneo, Ceylon, South India are given as the distribution. It is very common in the North Kanara District of Bombay and is met with in the vicinity of Dharwar town so that it is more than probable it is to be found wherever there is a rainfall varying from 300 inches to 30 inches wherever its foodplant is to be found, either at sea-level or 3000'.

#### Subfamily (2).—HESPERIINÆ.

This is a somewhat unsatisfactory subfamily but forms the best intermediary group between the butterflies with horizontally spread

wings when at rest and those with wings held perpendicularly closed over the back, that is between the *Celænorrhinæ* and the *Ismeneinæ*. Colonel Swinhoe characterises it as under:—

*Antennæ*.—Club robust, more or less straight, curved in *Thanaos* and *Carcharodus*. *Palpi*.—Suberect, the third joint blunt.

*Hind tibiæ*.—Two pairs of spurs, the upper pair very minute in *Thanaos* and *Carcharodus*.

*Fore wing*.—Vein 12 ends on the costa before the end of the cell; discocellulars suberect; vein 3 arises shortly before the lower end of the cell, 2 from before the middle; the cell is about two-thirds the length of the costa.

*Hind wing*.—Vein 7 arises just before the upper end of the cell, 3 from just before lower end, 2 from the middle—in *Carcharodus* a little more inwards, in *Thanaos* a little beyond the middle.

And he informs us also (*Lepidoptera Indica*, Vol. X, p. 95) of some interesting facts concerning the group:—

“In this subfamily we put *Hesperia*, Fabricius; *Spialia*, Swinhoe; *Pyrgus*, Hübner; *Caracharodus*, Hübner; *Thanaos*, Boisduval; and *Gomalia*, Moore.

“The first three were put by Watson into sections under *Hesperia*, but he himself states that it is a genus that wants splitting up.

“Species of the first three genera are distributed all over the world, except in the Australian region; *Thanaos* and *Carcharodus* are palearctic, *Gomalia* is apparently confined to South India and Ceylon.

“Doherty says that the eggs are small, hard, seven-eighths as high as wide or even higher, constricted at base, with wide scalloped anastomosing ribs, remarking that this group is very distinct and includes *Hesperia* and *Gomalia*.

“The life history of typical *Hesperia* is well known, the type *malvæ*, Linnaeus, being a common English species; for the life history of *galba*, Fabricius, the type of *Spialia*, we are indebted to Davidson, Bell and Aitken; their habits of life are very different.”

We know that the eggs of *Hesperia malvæ* at home in England (The Grizzled Skipper) and those of *Thanaos tages* (The Dingy Skipper) are dome-shaped and strongly ribbed with some 20 smooth-backed ribs with cross-rays between them that are much finer and lower. Those of *Hesperia* (*Spialia*, Swinh.) *galba* are exactly of the same type also. But that of *Gomalia* is very different in sculpture though more or less the same as will be seen if a reference is made to its description below under *Gomalia albofasciata*. The larvæ of *Hesperia* and *Spialia* are very similar, those of *Thanaos* and *Gomalia* have more or less naked heads, thus different from the others which have a clothing of long, more or less erect, blackish hairs; all the heads are, however, round, rather bullet-shaped. The pupæ of all of them are somewhat alike, having large, spiracular expansions to the spiracles of segment 2, a well-formed, more or less triangular cremaster, the thorax humped, the colour green or yellowish. The habits of the larvæ of *Hesperia*, *Spialia*, *Gomalia* are similar in the matter of manufacture of the cells and the caterpillars' way of lying in them; the pupation offers no



great difference of method in the various genera—that is in the three that are known in India; *Thanaos tages* at home seems to make a different sort of cell to the other three. In the matter of habits of the butterflies themselves there are important differences in the way the wings are held in repose. *Hesperia* (*Spialia*) hold them perpendicularly over the back as do all the *Ismeneinæ*, *Pamphilinæ*, *Erynninæ*, &c. that come after them in classification. *Thanaos*, according to available information, rests with the wings penthouse-wise like most moths. *Gomalia* assumes both or either of these positions indifferently as will be seen under that insect further on. They all agree in that the larvæ feed only upon dieotyledonous plants. The butterflies are all quick in flight, frequent low herbage and live in the open country and, in India, always, with the exception of *Spialia galba* (*Hesperia galba*), at levels above 2,000 feet above the sea. *H. galba* is found at all heights, even along the sea-shore.

#### Genus 9.—HESPERIA.

Quoted as under, following Swinhoe in *Lepidoptera Indica*, Vol. X :—

*Antennæ*.—Less than half the length of costa of fore wing, the club robust arcuate, blunt at tip, with no terminal crook.

*Palpi*.—Suberect, second joint laxly clothed with longish scales, third joint slender, blunt, almost concealed by the scaling of the second.

*Hind tibiæ*.—With two pairs of spurs; no tuft of hairs in male.

*Fore wing*.—Vein 12 not straight but slightly recurved before bending up to the costa, ending there some distance before the end of cell; discocelluars suberect, the lower the longer, vein 3 emitted a little before lower end of cell, 2 from a little before middle; cell a little less than two-thirds length of wing; costa arched at base, then nearly straight to apex, the apex and outer margin evenly rounded; no costal fold.

*Hind wing*.—Vein 6 emitted quite close to the upper end of cell; discocellulars and vein 5 very faint; vein 3 from immediately before lower end of cell, 2 from a little beyond the middle.

Swinhoe has the following genera, based mostly on male characters of wings and legs :—

A. Male with no costal fold to fore wing ..... *Pyrgus*.

B. Male with a costal fold to fore wing.

a. Male with a pair of scabbard-shaped, scaly and hairy appendages springing from the breast posteriorly at base of hind legs and about one-third the length of the abdomen ..... *Hesperia*.

b. Male without these appendages.

a<sup>1</sup> Antennæ with the club absolutely blunt in both sexes.

a<sup>11</sup> Wings on the upperside spotted all over with numerous white spots ..... *Spialia*.

b<sup>11</sup> Not so.

a<sup>111</sup> Hind wing dark-brown, immaculate ..... *Thanaos*.

b<sup>111</sup> Hind wing with white band ..... *Gomalia*.

b<sup>1</sup> Antennæ with club minutely apiculate ..... *Carcharodus*.

Only *Spialia*—Which will be called *Hesperia*—and *Gomalia* need trouble us here. But it is interesting to know from Colonel Swinhoe that “Lang says that the position of the wings of *Hesperia*

*cashmirensis* during repose is different from that of the butterflies of any of the other families, the hind wings being held in a horizontal position, the fore wings only half erect; the wings are never closed perpendicularly over the trunk, the inner margin of the hind wing is not deflected but is thrown into a slight fold, so that there is no canal for the reception of the abdomen." This gives another position for the wings in the family. Of course *Hesperia* (*Spialia*) *galba* often parts the wings too *when basking* in the sun, keeping the hind wing nearly horizontal while the fore wings are half opened; it has never been observed that the hind wing was anything but quite horizontal although the fact that it was may have been taken for granted. It may possibly be held as for *Hesperia cashmirensis*.

**211. *Hesperia galba*, Fabricius**—Pl.M., figs. 80 ♂, 80a ♀.—Male. *Upperside*—Black with slight olive tint, spotted with white. Fore wing with three spots in the cell, subbasal, medial and terminal; a spot on the submedian vein below the subbasal spot; a discal series of eight spots commencing with three that are subapical and close together from near costa in interspaces 6, 7, 8, then two together in 3 and 4, the lower the larger followed by two larger and more or less conjugated a little inwards in interspaces 2 and 1 and one still further in on the submedian vein; a complete submarginal series of small spots, one in each interspace 7 to 2 and two in 1; four short, white streaks on costa between middle and apex; there are a few white scales at base of the wing spreading along costa and inner marginal area for some way; inner margin with short brown hair fringe. Hind wing with a subbasal white spot in cell, a large, somewhat quadrate white spot at the end of the cell with a smaller one below it in interspace 2 and a still smaller one above it interspace 6; a submarginal series of small spots from anal angle becoming obsolete upwards; some longish grey-whitish hairs on hinder part of wing and a short, white fringe on abdominal edge. Cilia of both wings checkered black and white. *Underside*:—Grey of a shade variable with the locality and with a certain area of fore wing nearly always brown; the hind wing always very much greyer. Fore wing with the spots as above but larger, the apex, inner margin and costa rather broadly grey, the rest of disc very much lighter brown than the upperside, all the spots similar, perhaps a little larger. Hind wing with the abdominal fold bluish-white; three subbasal spots in cell, interspace 1 and interspace 7, this last with even a further one indicated in 8; the spot at the end of the cell forming part of medial, transverse whitish band with irregular margins from costa to abdominal fold; submarginal spots as on upperside; the ground colour of the hind wing is often ochreous brown of a greyish shade due to a thick overlaying of the brown ground colour with very light brownish-ochreous scales; the edge of abdominal margin with a fringe of white hair. Antennæ brown above spotted with white, the club sometimes tipped chestnut but pure white below with most of the club chestnut; palpi, head and body above concolorous with wings, the abdomen banded with intersegmental, narrow bands of grey; beneath everything white including legs. Female. Usually darker than the male, markings similar, the spots of upperside often smaller. Expanse up to 25mm.

*Egg*.—Dome-shaped, perfectly rounded on top where, centrally, is a depressed micropyle. Surface shining and covered with small, 0.05mm. × high tubercles, irregularly hemispherical in shape and arranged in meridional lines: 20 or 21 such lines all round the egg, only about 8 actually reaching the circumference of the micropyle-depression, all the others shorter. Colour pale grass-green with the tubercles whitish; on the whole the meridions are very regular though not quite. B. 0.7mm.; H. 0.5mm.



*Larva*.—The body is in *shape* somewhat like a spindle, the anal end somewhat narrowly rounded and held rather high off the surface, the claspers being perpendicular beneath it, short; fattest in the middle decreasing in width to both ends about equally, segment 2 much narrower and lower than head, orange-brown of a light shade with a transverse, narrow, black collar nearer hinder margin broken by a light, thin, dorsal line; legs and true legs short; *head* comparatively very large, round, deep, rugose, shining black, covered with fine, close, light yellowish fur on the face and set with very long (comparatively), erect, black and white hairs (some are longer than the head is broad) some of the black ones being longest and stout, thickening to their extremities; the front of the face has only short, white hairs, longest about the mouth-opening; clypeus hidden by the fur; labrum and ligula orange-brown; mandibles black. *Surface* of body covered fairly closely with tiny, white, truncated-conical tubercles (say 26 to each transverse row from the dorsoventral margin on one side, to that of the other side) each of which bears a long, white or brown, erect hair, the brown ones confined to the front part of the body; the segments are well-marked and there are the usual, transverse, parallel, depressed, fine lines to each segment, in front of and parallel to the hinder margins. *Spiracles* broadly oval, small, brown-yellow in colour, flush; those of segments 2 and 12 much larger. *Colour* glaucous-green with a darkish, dorsal, pulsating line and a whitish, spiracular line. L. 16mm.; B. 4mm.

*Pupa*.—Stout, in *shape* more or less cylindrical from shoulders to end of wings, then conical to end; the head-piece square broader than long, slightly "bossed" between the eyes which are themselves prominent, the vertex convex; segment 2 long, convex; thorax slightly humped and evenly convex; shoulders evenly rounded; a slight constriction behind thorax; the body is fattest at middle and slightly broader there than at shoulders; the abdomen curved down: cremaster transversely convex, short, square, hollowed out ventrally, narrow, set with a dense tuft of hooked shaftlets at extremity; from fore-end to end of wings is about two-thirds the total length of pupa; hinder margin of thorax nearly a semicircle meeting the wings in a broadly-rounded, deep angle of about 80°. *Surface*, all except the wings, covered with long, white, fine hairs, densest about eyes and on head; all the segments well-marked; the hairs are all about as long as segment 2, appressed more or less to surface; the proboscis reaches free beyond the wings only very slightly. *Spiracles* of segment 2 have large expansions oval, convex, transverse, standing out from surface of the thorax, dark chocolate-brown in colour with a slit down the middle; the other spiracles small, oval, light-brown in colour, more or less flush with the surface. *Colour* of body greenish-yellow or light yellowish-green; of thorax, wings and head, green; of cremaster, brown; suspensory hairs or shafts bright golden. L. 12.5mm.; B. 5mm. H. nearly equals breadth.

*Habits*.—The larva doubles up part of a leaf on top or underneath, fastening it down tightly all round and lining the inside thickly with silk; before turning into the pupa makes a strong cell by lining the inside still more thickly. Of course it changes the cell as often as necessary during growth to suit its size—it always fits the body fairly closely. The pupa is covered all over with a white, creous powder excreted by the larva. The pupa is attached by the tail very strongly and seems to have no body-band. The larva rests inside with its head turned round on its side. The egg is laid on leaves, stalks, shoots or grasses near at hand. The foodplant is *Waltheria indica* (*Sterculiaceæ*), a low, often inconspicuous weed, growing flat against the ground amongst the grass; although it does grow erect

where opportunity offers. It is common throughout the country from the sands of the sea-coast to the open plains of the Deccan, fields, grass-lands, all places. The little larva is very sluggish in its movements and does not like the light although inhabiting the sunniest, openest situations. The butterfly flies fast and keeps to the ground, being fond of flowers and the sunlight. It basks on the ground or leaves close to the ground and, when doing so, keeps the wings open half-way, the fore wings in a different plane to the hinder ones which are generally held nearly horizontal. At night it rests on grasses, flower-heads, &c. with the wings closed over the back and may be caught with the fingers in the early misty and dewy mornings when numbed with the cold. When flying it is very difficult to see as the checkered grey and black blends well with the sunny ground and grass-shadows: besides, it is very small and quick, although it never flies very far. It is more difficult to see, even, than the smallest of the Indian skippers, *Aeromachus* which is dark-coloured and not nearly so marked—indeed it is not at all protectively marked. The habitat is India, Ceylon and Burma, and it is found in regions of heavy rain and in the driest places where the rain is slight; in hills and plains, in forest or open country at all elevations. Swinhoe says “Recorded from the Chin Hills by Watson, and Pungadaw, Upper Burma; by Manders from Fort Stedman in the Shan States; it is a common species throughout India and Ceylon and has been recorded from many localities; we took it at Poona, Bombay, Mhow, Karachi and have it from Ranikhet, Kurnal, Raipur, Madras, Kandy and the Khasia Hills and it is in the British Museum also from Barrackpur near Calcutta, Ganjam, Ootacamund, the Shan States and Burma. We cannot separate *Pyrgus evanidus*, Butler (Swinhoe places this insect in the genus *Pyrgus*), from *galba*; his type from the Habb River, just outside the Sind border, was taken by us: it only varies from *galba* in its smaller size and in having the white, discal band of the hind wing on the underside more or less broken up; in *galba* it is complete; we took many examples of both sexes of *evanidus* in Sind, all in mid-winter; it is undoubtedly the extreme cold-weather form of *galba*. Yerbury took it at Campbellpur in the cold weather. Our figures of the larva and pupa are from Davidson’s original drawings, bred at Karwar.”

The insects are represented on Plate M, figures 80 and 80a, male and female respectively. They are fairly good but the female is too red on the underside as usual. The red dot at base of fore wing at inner margin should not be there. The abdomen of the male is too black.

#### Genus 10.—GOMALIA.

According to Swinhoe characterised as under:—

*Antenna*.—With a somewhat slender club, blunt at the end, no terminal crook or sign of one, not half the length of costa of fore wing.



*Palpi*.—Suberect, second joint clothed with longish scales, the third blunt, more or less concealed by the hairs of the second.

*Hind tibiæ*.—With two pairs of spurs, more or less of equal size, the terminal ones thicker; fringed lightly with longish, white hairs in both sexes on the outside.

*Fore wing*.—Vein 12 ends on costa well before end of cell, 11 at end, level with it; discocellulars suberect, the lower very slightly the longer; vein 3 emitted before lower end of the cell at a distance from and about equal to lower discocellular; 2 from before middle; cell a little more than two-thirds the length of costa, costa slightly arched, apex subacute, outer margin evenly convex, shorter than the inner margin which is nearly straight. The surface of wing covered with decumbent, white hairs fairly closely, the inner margin with a short fringe of them. Male with a costal fold.

*Hind wing*.—Vein 7 from close to upper end of cell, 3 close to lower end; discocellulars and 5 very faint; costa lightly arched at base, outer margin evenly rounded; hinder half of wing clothed with long, greyish-white hairs and fringe of similar, shorter ones on edge of abdominal margin.

There is only one species; descriptions of *egg*, *larva*, *pupa* and *habits* will be found below.

**212. *Gomalia albofasciata*, Moore.**—Male. *Upperside*. With the ground colour brownish olive-grey. Fore wing with a basal blackish-brown band and an antemedial darker band, the latter with its outer margin limited by a thick, black line which extends from the subcostal vein to the submedian vein in an outward curve, the portion in the cell edged by a semihyaline somewhat lunular mark closing the cell; a semihyaline, yellowish-white spot at the base of interspace 3, another inwards below it in interspace 2, almost touching the one in 3; a curved series of three contiguous, subapical, semihyaline similar small spots in interspaces 6, 7, 8 and, sometimes one still smaller below, in 5 with a rather large dark, quadrate patch on costa limiting the series inwards; a similar, but smaller patch at apex of wing; a larger dark patch at middle of outer margin extending triangularly inwards to the spots in interspaces 2 and 3 and bordered by a whitish shade; another brown patch at tornal angle, longer, extended along inner margin then along outer, also bordered whitish above; the hair-covering and fringe along inner margin as for genus. Hind wing darker than the fore wing, brown with a broad, white, medial band from vein 7 to the abdominal fold and a white subbasal mark in the cell on the nearly quite black basal third of the wing; a black band bordering the white, medial one outside, narrowing upwards, bordered in its turn by a whitish shade beyond which the terminal portion of surface is black with a grey wash at tornal area and a white, terminal patch at end of vein 5; longish grey hairs clothing the hinder half of wing, the abdominal margin-edge fringed white. Cilia of fore wings brown with some grey scales; of hind wings nearly pure white except at anal angle where they are brown and grey. *Underside*: grey. Fore wing really brown overlaid with grey scales which become brown outside the cell and below it except for the internommedian interspace along the inner margin which is white extending somewhat up into the submedian interspace, right up to vein 2 in a quadrate patch under the semihyaline spot in interspace 2, a bit inwards of it; the semihyaline spots as on upperside, silvery; but none of the other markings. Hind wing; also brown overlaid with whitish scales and with white hairs in the cell; the subbasal cell-spot and broad medial, white band present, the latter extending right up to the costa, the cell-spot joined to another white spot, a bit outwards of it, in interspace 7; the abdominal fold blue-greyish, the anal angle with a short, white submarginal band running up from it and the white patch on outer margin between veins 4 and 6

just indicated. Female. Larger, lighter in colour above and below. Fore wing above is similar to that of male, the hind wing also. *Underside*: With grey decumbent hairs in cell and along costa above cell not found in male; markings similar to male, larger in both fore and hind wing. Antennæ concolorous with wings above, speckled with white on the shaft but with the club black, white below; body and abdomen concolorous with wings, above, white below, the abdomen with light intersegmental bands; palpi with third joint concolorous with wings, white below.

*Egg*.—Is peculiar in the sculpture. It is dome-shaped, somewhat depressed rather less than twice as high as broad. The surface is rather dull and occupied by coarse, somewhat irregularly-rounded prominences, or knobs of considerable size; occupying the top of dome is a lid, circular in shape, quite half the diameter of the whole which opens to allow the little larva to emerge; this lid is composed of six very broadly-club-shaped convex prominences surrounding the micropyle-surface in the centre which is also circular and takes up the central third of the lid, the narrow ends of the club shaped prominences touching each other round this surface; surrounding this lid is a series of circular (more or less) prominences to the number of twelve, the series not quite regular, very nearly touching the lid prominences; outside this is another series of rather more knobs and beyond that another, three in all. When the larva is ready to come out it eats away the intervals between the clubs, leaving them quite intact and connected by the micropyle-surface; this lid, then a star-shaped piece with six broad rays, comes away, allowing free egress. The colour of the egg is white when first laid becoming reddish-orange later on with the rays and knobs always white and concealing most of the ground colour. B. about 0.90mm.; H. about 0.5mm. B. of lid about 0.3mm.

*Larva*.—*Shape* is more or less the usual shape of all skippers: the transverse section a circle flattened on the ventrum; the anal end is narrowed from behind the middle of body to extremity, the 13th segment being apparent, as along as half the 12th and divided into two parts by a line transverse to the body; the anal segment is nearly semicircular in outline and overhangs the anal prolegs slightly: the curve is very even and the edge thin, the dorsal slope being about 30° to the longitudinal axis of the larva; the thickest part of body is just before the middle whence it thins gradually to segment 3, segment 2 being still narrower, the head about the same diameter—perhaps slightly less, the neck short but distinct, the head being certainly broader and higher than it; the prolegs and anal claspers are short and held well beneath the body as in all butterflies, the true legs also rather short. The *head* is rather broader than high, otherwise nearly circular and has a shallow, very broad and gradual vertical sinus or curve dividing the two lobes; the clypeus is triangular but hardly noticeable, being one with the rest; face rather flattened; surface of head hexagonal-celled rugose minutely, hardly shining, covered all over fairly densely with erect, plumose, brownish, short hairs, nearly wanting on the vertex of the head and simple on clypeus; the labrum is shining, short, transverse, the ligula also short, broad, shallowly sinuate in middle anteriorly, both the same colour as the whole head though the labrum in some lights looks lighter; the colour of head, antennal joints, eyes, all very dark red-brown, nearly black. *Surface* of body dull, transversely thinly lined near margins of segments, the segments not at all constricted; the whole covered all over with small, densely disposed (not enough to hide the skin in any way), fine, white translucent, erect hairs which are branched into 2 and 3 short branches at their extremities; besides a fringe of longer, soft, erect also moderately plentiful hairs along dorsoventral margin, densest and longest on anal segment; all quite distinct under a lens and each rising from a minute colourless tubercle. *Spiracles* very small, roundly oval, light soiled yellow, those of segments 2 and 12 much larger. *Colour* soft villous.



looking white with a greenish shade and indications of a slightly darker dorsal line; ventrum, legs and prolegs light green; segment 2 is nearly smooth except for the lateral posterior portions. L. 20mm.; B: 4mm.

The penultimate stage is the same; the antepenultimate has a thin, black collar across middle of segment 2, transverse; the one before that has the whole of segment 2 black; the egg-caterpillar, again, has the thin, black collar.

*Pupa*.—Is an ordinarily *shaped* little chrysalis broadest just at shoulders, the same breadth practically continued to segment 7 middle, after which it decreases gradually to segment 9 and more rapidly afterwards to the pointed cremastral end; circular in transverse section in all that portion (from shoulders to segment 13); segment 12 equalling 11 in length, segment 13 being half the length of 12 and the anal segment a broad, short triangle with the apex produced into a dorsally and ventrally flattened, somewhat down-curved, parabolic piece, half as broad as the posterior margin of segment (or anterior margin of segment 13), the apex of parabola or end of pupa set with a bunch of golden-brown, hooked shaftlets which are half as long as the segment, by which it is attached to little pad of laxly-spun, white silk. The front of the pupa is broadly blunt, formed of the lowly and broadly rounded or convex frons of the head between the somewhat prominent eyes of which only the top portions are narrowly visible from above and separated from each of these by a minute, sharp sinus; the lateral outline to shoulders being formed thereafter by the outline of these eyes further back and a small portion of the front of the thorax, for the head is somewhat bowed and the frons low, so that the dorsal and ventral head-surfaces are separated only by a low bit of the frons which is in a plane at right angles to the longitudinal axis of the pupa; the change from the ventral aspect and from the perpendicular frons to the vertex is of course gradual and rounded; the vertex of head is rather broad between the eyes and, chiefly, between the bases of the antennæ, it is in a plane at about  $45^{\circ}$  to the longitudinal axis and segment 2 and the front half of thorax are also similarly inclined; segment 2 is rather short, only moderately convex transversely and straight along both posterior and anterior margins (*i.e.*, these margins are quite parallel to each other transversely across pupa); the thorax is very moderately humped (convex longitudinally, and transversely) highest about the middle (may be a little before) which is the highest point of the whole pupa, thence gently sloping to hinder margin which is a somewhat broad parabolic curve meeting the wing-line in a very broadly rounded, rather deep angle of  $45^{\circ}$ ; the visible part of segment 4 thereafter is, in the dorsal line, the same length as segment 5 and this latter is somewhat shorter than segment 6; indeed segments 5-11 are about equal in length; the ventral line is straight from head to near the ends of wings where it is very slightly convex, then slightly concave to end, as the end is somewhat turned down; the proboscis is free at its extremity from the end of wings to near the hinder margin of segment 9, the wings themselves being slightly produced at their apices: the proboscis is stout, very slightly broadened toward extremity and then somewhat bluntly pointed. *Spiracles* of segment 2 are large, oval, very prominent raised perpendicularly from thorax-surface on hinder margin, slightly convex transversely and longitudinally on front face, the colour light brown with the hinder margin black; the rest of the spiracles are small, oval, convex, light brown with black central slit. *Surface* of pupa is somewhat dull, aciculate-striate very superficially on thorax, rather distantly, minutely pitted on abdomen, more or less smooth on wings, shining on segment 14; the whole surface except wings and the major part of cremaster, covered with short, erect, fine nearly white, sometimes minutely bifid hairs all over; this again all powdered with a white cereous powder more or less thickly. *Colour* very light, dead-yellow somewhat flushed brown on dorsum of the whole pupa, darkest on segments 1-3; the end of proboscis dark-brown; the cremaster soiled, lightish brown-orange. L, 12mm.; B, 4mm.

*Habits.*—The egg is laid on the top surface of a leaf, not necessarily a particularly young one; the little larva eats the lid free and goes to the underside of the leaf at once where it cuts itself a small, nearly round cover from the edge, leaving it attached at a point on the edge and turns it over onto the underside. It fixes this down and lives under it, coating the inside with silk laxly and eating in the immediate neighbourhood. In the next stage it cuts a much larger, more or less square or oblong, piece from the edge inwards and turns it, generally, onto the upperside, living underneath and coating it with silk as usual, after fastening it down all round. Finally it doubles a whole leaf sometimes. None of the fixing-down after the first cell is particularly tight. The pupation takes place in a more tightly-woven and strongly closed cell, often made of young leaves which wither and fall or get caught up somewhere; so that, presumably, the cell is as often as not made amongst withered leaves or in a withered leaf.

One egg was found on	..	..	..	8th June 1916.
Larve emerged therefrom	..	..	..	10th " "
Changed into second skin	..	..	..	12th " "
Changed into third skin	..	..	..	14th " "
Changed into fourth skin	..	..	..	18th " "
Changed for last time	..	..	..	24th " "
Pupated on the	..	..	..	3rd July 1916.
Butterfly emerged on	..	..	..	16th " "

giving about forty days for a generation. The larvæ are shy of a very bright light and, in consequence, feed in the immediate vicinity of their cells on the leaf upon which it has been made. They are not particularly sluggish and sit in the cell at rest with the head turned round on the side. The butterfly flies quickly and in spasmodic starts and jumps so to speak; it settles on a leaf and is gone. It appears to fall off or jump off but that is about all that can be seen. It visits flowers in the mornings and afternoons. During the day, in the intervals of flight, it sits with the wings raised half way between the horizontal and perpendicular, the upper half of fore wing, the apical part that is, bent down slightly, the fore wing normally separated from the hind wing. In the mornings and evenings, when resting, the wings are generally held horizontally out, the costa of the fore wing at about  $45^{\circ}$  to the axis of the body or, in other words, the fore wing covering the hind wing partially. It has been observed resting at nights with the wings held perpendicularly over the back as in *Parnara*, *Hasora*, &c. The foodplant of the larva is malvaceous and it has always been, so far, *Abutilon indicum*, Sweet, a common weed all over the Deccan, in the Plains country. The insect is never found in the jungles or hills being apparently confined to regions of light rainfall above 2,000 feet level in Bombay. It is common in Dharwar, Poona, Khandesh Districts. Swinhoe says the



type came from Ceylon; that it exists at Karachi in Sind and he took it at Poona and has it from Madras and from Quetta; Evans records it from the Palni Hills and Moore from Kangra. He says it is a scarce species, though widely distributed within India, Ceylon and Baluchistan.

*(To be continued.)*

## BIRDS' NESTING WITH A CAMERA IN INDIA.

By

CAPTAIN R. S. P. BATES.

PART I.

(With 6 plates.)

## THE SIND AND LIDDAR VALLEYS, KASHMIR.

It was towards the end of June 1920, that I left Srinagar by tonga in time to reach Ganderbal at the mouth of the Sind Valley before tiffin. After this having arranged pony transport for the next morning, I went out into the rice fields to look for nests of the Northern Ruddy Crake (*Amaurornis fuscus bakeri*). My efforts were not attended by much success, as I returned to camp very wet, very dirty and perspiring freely from the efforts of plodding through 18 inches or so of soft mud, having been shown one nest, which was said to have been ravished the previous day, and having flushed a brooding female off another but newly completed. However it served to strengthen my opinion that this crake prefers rice fields and ditches to large reed-covered jhils, of which more elsewhere.

The first day's march was not worthy of note, as the Sind Valley is here very open, and the avifauna differs little from that of the main valley. Beyond finding some sort of Willow-wren's nest containing young ones, and seeing a pair of Red-headed Buntings (*Emberiza luteola*), I noticed nothing of outstanding interest. Willow-wrens and warblers are most confusing birds. Many have such slight differences, that unless one is prepared to shoot on sight, and then examine the shattered remains with the aid of a book, it is usually impossible to say for certain to what species the victim belongs. Thus the identity of this Willow-wren, whose nest I found on three other occasions, all containing small young ones, remains a mystery, although I suspect it to be the Greenish Willow-warbler (*Acanthopneuste nitidus viridanus*). The owner of the nest in question showed itself to be a creature of fixed habit. In a cavity in a branch, the nest had two entrances, or rather according to the tenant an entrance and an exit, as it invariably went in at the top hole and reappeared, when the excitement, which the sight of food always seems to create in children, had somewhat died down, out of another hole about a foot further down the trunk. I have often noticed this trait in birds. A Tailor-bird, which had its abode in a creeper on the verandah of a bungalow I was recently occupying, always pitched on the lowest branch of the creeper, and hopped up invariably by exactly the same route to its nest some four feet higher up. And a Red-flanked Bush-robin (mentioned later on) had the same trick as the Willow-wren, entering its nest, which was under a fallen stump, from one side of a piece of loose bark and leaving from the other. In this case I was able to observe that both the male and female did likewise.

The next day I succeeded in finding a Plumbeous Redstart's (*Rhyacornis fuliginosa*) nest containing three young ones. This was on the underside of a stump overhanging the river, which was now a raging torrent of intensely cold snow-water. This made the getting of photographs a rather unpleasant job, as I had to fix up the camera in the water. The Plumbeous Redstart has all the attributes of the true Redstarts with a great partiality for water thrown in. It is a restless Robin-like bird with a short tail, which it is continually vibrating, and which is of totally different colouration in the two sexes. In the female the base of the tail is white, and this white increases on the outer feathers towards the outside, the outermost feather being almost entirely white. The remainder of the tail is bluish brown. That of the male is wholly bright-chestnut. They effect every mountain torrent and all the side rivers of Kashmir up to considerable elevations, but are not to be found in the main valley, where



the current is sluggish. They feed on the insects on the wet rocks, and sometimes flutter into the air after winged prey. The nest is cup-shaped and made of moss and roots and is lined with hair and wool. The situations chosen are a ledge, well concealed by grass and ferns, the underside of an overhanging tree-trunk, sometimes a fork of a tree, or the masonry of a bridge, and are nearly always overlooking the water. The eggs, four in number, are white, thickly mottled and spotted with yellowish and reddish brown, and are about .76" by .6".

At Gund I began to meet with the Eastern Meadow Bunting (*Emberiza cia stracheyi*), evidence that the bed of the valley was steadily rising, as I have never found this bird lower than a thousand feet above the main valley. This Bunting is the favourite dupe of the Asiatic Cuckoo, but it was now rather too late to hope to find the latter's egg. At Koolan I found two unusual nests of this species, as they were both substantially built cups well off the ground in bushes. The usual nest is rather a flimsy affair placed at the foot of a bush, in the side of a bank or in long grass. The eggs remind one strongly of the Yellow-Hammers', often having the same pencilling, though not usually to such a great extent. I also obtained one most curious egg of this species here, a light grey ground with a zone near the large end of thin concentric circles of a dried-blood colour.

For two reasons I decided to remain one day at Koolan. Firstly because I had decided to cross over into the Liddar Valley, and Koolan is the starting point, and only the previous day there had been a very bad storm, covering the hills with snow down to a thousand feet or so of the valley, probably rendering the Yamhar Pass (13,400 feet) uncrossable. Secondly because from the bushy slopes just above my camp came the far-reaching and long-drawn-out whistle of the Pale Bush-Warbler (*Horornis pallidus pallidus*), a small insignificant bird with a wonderful voice and a still more wonderful egg. There is no need to describe the bird as its notes are frequently uttered and absolutely unmistakable—a plaintive monotone, which one can never quite locate, and which goes on until one feels the bird must collapse from sheer exhaustion. When it does eventually come to an end, it is finished off by two quick sharp notes. It also possesses a rather feeble song. The nest is an untidy globe of grass lined with feathers; but the egg a rich uniform purple brown.

I entertained great hopes of finding a nest, as but a week before a friend had taken one near Srinagar containing four fresh eggs. I had no luck, however, and, returning to camp, consoled myself by taking photos of Jungle Crows (*Corvus coronoides intermedius*), which I enticed into range with pieces of a vile and uneatable plum cake, a ghastly attempt on the part of my cook. The Jungle Crow of Kashmir is a far finer specimen than that of the plains. The bird of the Nilgiris nearly approaches to it, but is I think considerably smaller. There is an even greater difference in the eggs. I was shown a clutch taken at Kotah in Rajputana, which were little if any bigger than Indian House Crows'. Whereas those I have seen taken in Kashmir are about as large as Carrion Crows. The markings too are much pronounced.

The first stage of the appallingly stiff ascent to the Yamhär yielded little beyond perfect views, and even these were few and far between, as the thick deodar forest afforded one but few glimpses of the snow-capped hills, into which one was mounting. When perhaps about 2,000 feet above the valley, i.e., about 9,000 feet up, I came across a Small-billed Mountain Thrush (*Oreocincla dauma dauma*) on its nest among the exposed roots of a deodar. This bird is an exceedingly close sitter and I made an abortive attempt to catch it. I really believe it would have allowed me to photograph it as it sat, and I regret that I did not make the attempt. Once flushed it made off straight down the hillside and never put in another appearance. There were four eggs in the nest, which was made of roots lined exclusively with pine-needles. Three of the eggs were



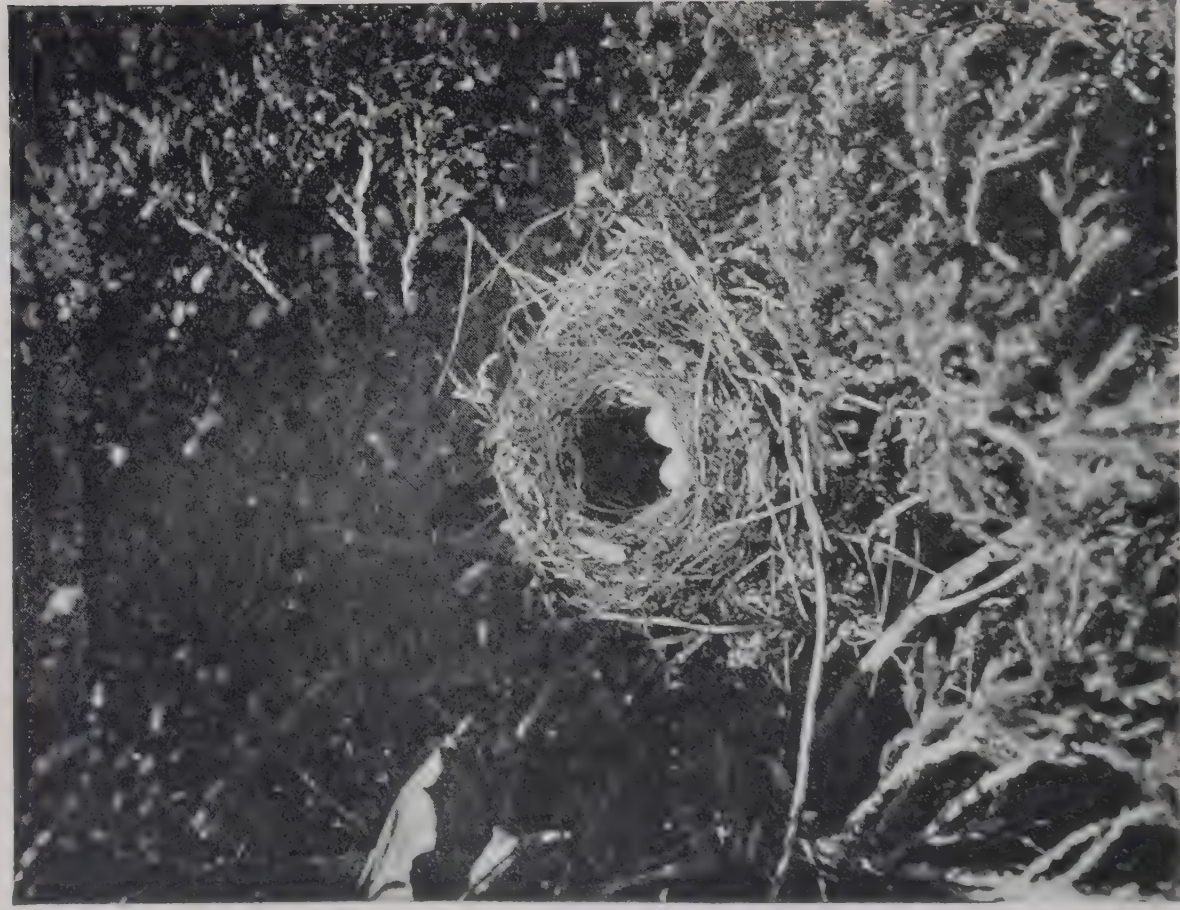


THE HIMALAYAN JUNGLE CROW (*Corvus coronooides intermedius*).



THE EASTERN MEADOW BUNTING (*Emberiza cia stracheyi*).





JERDON'S HEDGE-SPARROW (*Prinella strophias jerdoni*).



HUME'S LESSER WHITE-THROAT (*Sylvia alba*).



normal, a greenish white background specked with pale reddish. The fourth was rather a freak, being very large and having the markings collected in a band round the larger end. The sitting female reminded one strongly of a Song Thrush (*Turdus musicus*), owing, I suppose, to the wearing down of the fulvous margins of the feathers.

Shortly after this I espied a Grey-headed Ouzel (*Plumesticus castaneus castaneus*) with its beak full of wriggling insects. After watching it for some time, I came to the conclusion that its nest was somewhere in a low bank just below me. As I was on the point of jumping down, a movement caught my eye and there, where I had intended landing, was a beautifully marked but very evil looking viper just uncoiling itself. I disposed of it hastily with my khudstick, and then discovered that it was evidently there with the intention of satisfying the inner snake, as there too in a slight depression was the Ouzel's nest with two naked young in it. This is the only time I have ever found a Grey-headed Ouzel's nest on the ground. A decayed stump seems to be a favourite site, and I have found them more than 10 feet up against the side of a tree trunk.

I was now at about 10,000 feet and the nature of the forest began to change, birch becoming increasingly plentiful. With this change the avifauna too showed distinct alterations, Flycatchers, Nutcrackers and evidence of a large Woodpecker becoming numerous. I frequently noticed a little Robin-like bird, which I find I described in my diary, written at the time, as "a little earthy coloured fellow with a white throat and abdomen, red flanks and large inquiring eyes, which obviously say: "Who on earth are you. If you mean mischief, go away." Its peculiarly suspicious manner struck me afresh at every encounter. This was the Red-flanked Bush-robin (*Ianthia rufilata*), the female. The male is a much darker bird, having the upper plumage and a patch on the cheeks, extending down the neck and on to the sides of the breast, a dark blue. It has an ultramarine blue eye-stripe, upper tail-coverts, rump, and median wing coverts, and of course the red flanks. They are possessed of a very hoarse danger note like the rasp of a file. I eventually found the nest containing young, which I mentioned earlier on in this chapter. This was procured close to camp at Zaiwan: Zaiwan consisting of a post to mark the camping ground dug into the centre of a small grassy marg looking out across the forest clad snow-capped valley. Three thousand feet below and but three miles distant across the tops of an unbroken sea of firs lay the Sind river, a narrow gleaming ribbon emerging from the frowning narrows of Gangangair. After arriving in camp and while refreshing myself with a cup of tea and the glorious view, I was visited by a Jungle Crow with two distinct white wing bars. I had also noticed one just before leaving Koolan, which had a large white patch in the left wing.

The next morning commenced with the most strenuous exercise I have ever experienced. In just over half a mile measured across the contours, but probably entailing twice that amount of walking, the path rose 1,500 feet. I had to content myself with plodding steadily upwards, and only took note of my surroundings during the many rests my overtaxed lungs forced me to take. The forest, which had for some time consisted exclusively of birch, here became stunted and soon ceased altogether. And so far I had drawn a blank. Some two and-a-half miles further on lay the pass, apparently a mass of snow and probably quite uncrossable, but in between lay grassy slopes dotted with patches of juniper bushes and many small streamlets of ice cold snow water.

The path, thank Heaven, ascended but very gently to the foot of the pass. The very first juniper patch, I investigated, yielded a small compact nest composed of roots and moss, lined with hair and a few downy feathers, and contained three beautiful blue eggs. Nest and eggs might have been those



of a Hedge-Sparrow transported straight from home. They belonged indeed to Jerdon's Hedge-Sparrow (*Prunella strophiatu jerdoni*). Later I found many more nests mostly being built, others containing but one or two eggs, but none as yet with their full compliment. This first nest was at an elevation of no less than 12,200 feet and was the highest I obtained, though I am sure that there were still more to be had at higher elevations.

At the foot of the pass, 12,500 feet, many Hodgson's Pipits (*Anthus roseatus*) were to be seen running round the edge of Kem Sär, a small half frozen tarn, and when I was laboriously pulling myself up the side of the Yamhär itself, feeling like an exhausted fly on a window pane, an Eastern Blue Rock Thrush (*Petrophila solitaria pandoo*) flew out of a mass of rocks I was crawling through, and seemed very agitated at my presence. Between 13 and 14 thousand feet hardly seems a suitable elevation, at which to bring up a family. The only other birds I noticed in this region were the inevitable Jungle Crow and the Lammergeyer (*Gypaëtus barbatus grandis*).

As soon as I had crossed the pass, which I was able to do by pulling myself up a narrow chimney, which the driving snow had left more or less clear, and which was about half a mile to the left of the actual road, and brought one out about 200 feet higher, I fell in with a bird for which I was especially on the lookout, namely, the Yellow-billed Chough (*Pyrrhocorax graculus*). The nature of the country was here very different. A narrow valley, commencing in a semi-circle of towering cliffs, descended more or less gently for some ten miles, eventually debouching into the Liddar Valley at Liddarwat. The right face of the valley was dominated by snow-covered heights of 15,000 feet or more. Himalayan Griffions and an occasional Bearded Vulture were to be seen like tiny specks, closely following the line of the cliffs. From the left bank of the tiny stream, which grew in volume with almost every step, rose grassy slopes strewn with masses of tumbled rocks, the homes of numerous marmots. Everywhere were patches of melting snow, forming tiny rivulets, at the edges of which many Hodgson's Pipits were feeding. Other vegetation there was none.

I pitched camp at Sekwas (about 11,250 feet) three miles down the valley. Here on the left too there was a massive perpendicular cliff, at the foot of which the patches of Juniper made their reappearance. Choughs were very plentiful. Bands of them sported overhead, one moment flying steadily like any serious crow, the next swerving, tumbling, and rolling earthwards in a peculiarly careless flight, the wind eddies amongst the broken cliffs probably accounting for these weird antics. The Yellow-billed Chough, slightly smaller than the Common Indian Crow is black plumaged, the wings and tail highly glossy, and has a short and practically straight yellow beak and red legs and feet. I was told by a friend, who was at this time at Sonemarg, which is not far distant and at about the same elevation, that there the red-billed variety (*Pyrrhocorax pyrrhocorax*), in which the bill is long slender and curved, was common, while not a Yellow-billed Chough was to be seen. The cliff was apparently their breeding place, as on two occasions I saw Choughs fly out to mob a Griffion Vulture, which had ventured too close. It was of course absolutely unscaleable, so I had to content myself with a distant view of their haunts.

July started with great promise. Two most interesting nests being found within a few yards of one another in the Juniper patch below the cliff: the first that of Tickell's Willow-warbler (*Phylloscopus affinis*). This was a loose sphere of grass about 5 inches in diameter with an entrance in the side. It was lined with Chough feathers exclusively, and held two minute and almost oval white eggs. One appeared to have a few microscopic red spots on it. The nest was only about a foot from the ground and very imperfectly concealed. I am sorry to have to confess that on this occasion I committed murder, as being the only means of establishing the identity of the bird.





THE EASTERN WHITE-SPOTTED BLUE-THROAT

(*Cyanosylvia cyaneula abbotti*).



THE HIMALAYAN SOOTY FLYCATCHER

(*Hemiteledon sibirica cacabata*).





THE PLUMBEOUS REDSTART (*Rhyacornis fuliginosa*).



THE DARK-GREY BUSH-CHAT (*Oreicula ferrea ferrea*).



The second nest was of even greater interest. It was let well into the roots of a bush, and was semi-domed, rather like a coconut with a piece cut out of it. Altogether it was about 7 inches in diameter with an entrance hole about  $2\frac{1}{2}$  inches across. It was composed of grass, with a lining of goat's hair, and there were four eggs, rather pointed, light blue with red markings at the larger end. They were very like large editions of the Indian Bushchats. I regret that on this occasion I did not have resort to the gun, but I was never quite certain as to who was the owner of the nest. I was unable to sit down and wait for it to return, as it was already late. I had struck camp in the morning and sent the coolies on ahead, and I was now further from my objective, Liddarwat, than when I started. As to the female I can only go by the story of the shikari, who found the nest by nearly putting his foot on it, and who, incidentally, having been engaged to find bears, was by this time quite convinced that his sahib was a little touched. According to him she was an earthy coloured bird with whitish underparts, and ran from the nest, sneaking someway through the bushes before finally taking to flight. One cannot however go by an Indian's description. Should he catch the flash of a small patch of red on an otherwise brown bird, it is quite on the cards that he would say the bird was "lal." A black and white bird might be either black or white but not both. However, I find I have also written the following in my diary; "A bird, which may have been the male, was the same with a blue throat and upper breast and about the size and shape of an English Robin." This bird came quite close to the nest when I was about 20 yards away. I am, therefore, of the opinion that it must have been the nest of an Eastern White-spotted Bluethroat (*Cyanosylvia cyaneacula abbotti*), which, I believe, is not supposed to breed within Indian limits. If any of my readers have also found this bird breeding in the Himalayas, I would be most delighted to hear from them.

One other nest besides numerous Hedge-sparrows' fell to my lot. A Hodgson's Pipit (*Anthus roseatus*) flew from under a stone by the side of a sheep-track, along which I was walking. The nest was the typical pipit nest, but the eggs were very much darker than the usual pipit's, having a distinctly purplish tinge about them. There were three in the nest. I was lucky to get a nest with eggs, as there were many young birds about. Hodgson's Pipit is a small dark pipit, and in summer is only to be found at high elevations. They are rather partial to water and stoney ground. In fact I never remember meeting with them on dry ground. They seemed to prefer feeding on the wet stones of the streams and round the edges of the tarns, running and fluttering about like wagtails. They have a sweet little song and the habit of most larks and pipits, but to a more marked degree, and when still some considerable height from the ground, of cocking up the wings and tail and fluttering down like a dead leaf or a butterfly at the mercy of the wind.

Descending below the 10,000 feet level, White-capped Redstarts (*Chaimarrornis leucocephala*) and Brown Dippers (*Cinclus Pallasii tenuirostris*) became increasingly common. Himalayan Whistling Thrushes (*Myiophonus horsfieldi temminckii*) were numerous from a higher level. Choughs were now nowhere to be seen. I had the luck to bring down a Snow Pigeon, the White-bellied Pigeon (*Columba leuconota*) of the "Fauna" (1st Edition), out of a flock, which suddenly burst round some birch trees, which were once again in evidence. Fine heavy birds with a strong swift flight they are, and really beautiful to behold. Like great balls of snow with wings grey, banded with brown, the primaries darker inclining to brown at the tips, a dark slate grey head, pale earthy brown upper back, and upper tail coverts and tail blackish brown, the latter having a broad crescent-shaped white cross-band.

I reached Liddarwat about 5 p.m., having used every plate I had out with me, and reeling in consequence that I had had a very successful day. Unfortu-



nately the photographs of the Willow-warbler's nest turned out failures: one being moved, the others for some reason I cannot now recall.

My tents were pitched on the left bank of the river on a little open space surrounded by birch and deodars, the latter predominating. The valley at this point is narrow and the hills immense and precipitous, yet thickly wooded to a considerable height. Here the sun rises late and sets early, great black shadows creeping over the river and darkening the opposite hillside in the early afternoon. The air is delightful, crisp and fresh in the morning and pleasantly warm during the daytime. I decided therefore that here was a charming spot to rest. I discharged the coolies, and made up my mind to remain until I felt inclined to move on, with due regard to the unhappy fact, that the powers that be claimed my presence amongst the barren hills of the north-west frontier in but 15 days time.

I had evidently struck one of those peculiar patches of forest, in which for some unaccountable reason all the birds of the neighbourhood seem to be collected. It may be that the feeding in such spots is superior to that in the surrounding tracts, but I often doubt that this can be the true reason, as to outward appearances at any rate there is often no difference in the vegetation or ground whatsoever, and, consequently, one would conclude, in the food supply. Nevertheless for some 300 yards above and below my camp the place teemed with birds; and beyond this limit the forest was as still as death. My tent was besieged by Jungle Crows; bands of noisy Tree-creepers dashed piping shrilly from trunk to trunk across my grass plot; Pied Woodpeckers would converse with one another in stacato tones; a family of Dippers gambled in the foaming waters and a Himalayan Whistling Thrush down by the river spent all the hours of daylight and most of the night in addition either mimicking every individual member of the avian chorus in turn, or roundly swearing at anything that might threaten its two hefty fledglings, sitting on a branch below it. Flycatchers literally teemed, and every now and then the sweet lay of a Kashmir Wren poured forth from a fallen trunk or moss covered boulder.

The first morning I passed repacking with greater care the negatives I had so far obtained, and after tiffin took up a commanding position about 200 yards from my tent door with my back against a tree, and proceeded to note with the aid of binoculars and my own eyesight the doings of the feathered population. By this means within a couple of hours I had marked down the nests of no fewer than two Sooty Flycatchers, a White-browed Blue Flycatcher, and two Large Crowned Willow-warblers. A Grey-headed Ouzel had a nest behind an enormous boulder, which prevented me from discovering its exact whereabouts. A Red-flanked Bush-robin evidently had its nest somewhere in the vicinity of a fallen deodar, but would not disclose its position, and a Kashmir Wren was busily feeding a large family amongst a small pile of undergrowth almost at my feet.

One is hardly likely to find the nest of the Himalayan Sooty Flycatcher (*Hemichelidon sibirica cacabata*) except by the above means. The bird realises thoroughly the advantages of camouflage, besides which it more often than not builds on a horizontal moss-covered branch or close up against a tree-trunk. The nest is small, and so in the former case from below merely gives one the impression of a slight thickening in the branch. The materials used are largely moss and lichens, and so closely resemble their surroundings. The lining material is hair. It is placed at anything from 15 to 40 feet or more from the ground and generally in a fir tree. The eggs 3 to 4 in number are pale green heavily speckled with reddish, and measure about .65" by .46". The breeding season is extensive. I have found nests being built and containing young in May, June and July. Both sexes are inconspicuous in coloration, but conspicuous otherwise, as they choose some high vantage point, to which they return again and again after frequent sallies in pursuit

of winged prey. Why do birds feed so seldom on butterflies? One would expect such fat luscious morsels to be at a premium. Yet I can recall few occasions, on which I have seen them molested, and then I have noticed that they are not always easily caught, being adepts in the art of dodging and swerving.

The Large Crowned Willow-warblers' (*Acanthopneuste occipitalis occipitalis*) nests both contained young ones. One was at the end of a narrow hole in the ground about a foot deep: the other well inside the decaying end of a fallen pine. The Crowned Willow-warblers are distinguishable by the yellow eye stripes and an additional stripe running from the forehead over the crown. They invariably give away the presence of their nests by a continual loud "teeing" whenever one is in their vicinity.

The White-browed Blue Flycatcher (*Cyornis superciliaris*) though a true flycatcher is rather different in structure and habits from the last named of the family, being rather slender in build. There is considerable dimorphism in the sexes, the male being entirely dark glossless blue above with a white eye stripe, and white below. The blue extends down the sides of the neck on to the breast, forming a partial collar. The female is in no way resplendent, being brown above with pale buff underparts and having dark spots on the crown of the head. The nest was about 7 feet from the ground in a cleft in the trunk of a birch tree, and was an extraordinary structure. First came a foundation of moss and on this a loose structure of thin strips, about 1/8 inch in diameter, of the skin of birch bark. It looked for all the world as if the builder had stolen the paper shavings out of a box of chocolates. A scanty lining of hair finished it off. Unfortunately the building operations were over, as there were three fresh eggs, so heavily speckled with biscuit brown as to completely hide the ground colour. They were slightly darker at the large end. They had a high gloss and a comparatively hard brittle shell and in size averaged .6" by .5". The male was by no means timid, and often came to admire his property, while I was quite close.

The following morning I returned to the same area, but took up a slightly different position. I was soon rewarded by discovering the whereabouts of the Grey-headed Ouzel's (*Planesticus castaneus castaneus*) quarters. These were somewhat unusual, being 12 feet or so above the ground in a thick tangle of small branches sprouting from the trunk of a large tree, of the name of which I am ignorant. Large feathered young ones were in possession, so I left them severely alone, not wanting to make them leave home prematurely, and so become prey to some ruthless marauder. Young birds are very perverse creatures: once startle them into leaving the nest, and it is often impossible to make them remain in it again; no matter how many times one puts them back.

Just behind me in the roots of another large tree was a nest of the Kashmir Wren (*Troglodytes troglodytes neglecta*) containing five young ones, some three or four days old. The Kashmir Wren resembles quite closely the English Wren in size, shape and habits, but is much barred and darker in hue, which readily serves as a factor in its identification. The nest is in no way different, and I have also found unlined nests just as one finds them at home.

While watching the Grey-headed Ouzel, the evolutions of a Sooty Flycatcher had attracted my attention. Every few moments it would fly past the same spot in the side of the dead birch, at the foot of which I had posted myself. I could see nothing unusual about the place beyond some loose flaps of bark. There was an enormous boulder close by, on to which I climbed. From this point of vantage, I found myself looking into the nest shown in the accompanying illustration. It contained three eggs in an advanced state of incubation. Allowing my gaze to pass beyond, I was surprised to catch sight of another nest of the same species on a horizontal branch of another birch a few yards



further down the hillside. From my commanding position it was most conspicuous, but from anywhere near the tree it was almost unnoticeable. It turned out to be empty, but next morning was found to contain one egg. I took this egg and put in its place one of the well incubated ones from the other nest. What a shock the parent birds must shortly afterwards have sustained, finding themselves saddled with a hungry child some days before scheduled time. The eggs in the first nest averaged .65" by .5" and were distinctly greenish, and the specks rather faint and brownish though just as profuse as usual. The single egg was of a slightly lighter shade and the markings normal.

During both my vigils I was visited by a Blue-headed Rock-thrush (*Petrophila cinclorhyncha*) a truly beautiful bird, and nothing like his soberly arrayed cousin the Eastern Blue Rock-thrush (*P. solitaria pandoo*). His head and throat were dressed in cobalt blue, ear coverts, back and the greater part of the wings, but for a white patch, and the tail in black, and the upper tail-coverts and entire under parts in bright chestnut. The primaries and greater coverts, and the tail feathers less so, are edged with blue. His abode I think must have been higher up the hillside. I could hardly expect his nest too to be in that little paradise. In a square of certainly not more than a hundred yards, in the space of a few hours I had found no less than the following nests—4 Sooty Flycatchers'; 1 White-browed Blue Flycatcher's; 2 Great Crowned Willow-warblers'; 1 Kashmir Wren's, and 1 Grey-headed Ouzel's. How many more were there, that I had missed? Why there must have been millions as the rustic answered, when asked how many thousandths there were in an inch.

Next day I decided to go to Kolahoi glacier, where the river takes its source, one of the sights of Kashmir, the mountain from which it springs being nearly 18,000 feet. I wasted the entire morning trudging along the left bank frequently getting tied up in side nullahs and plodding through silent deodars, which gradually gave way to birch and finally came to a straggling end, as one steadily mounted. For the first two miles or so the woods were uncannily silent, hardly a living thing to be seen, and I drew an absolute blank, merely coming across a couple of old Tree-creepers' (*Certhia himalayana himalayana*) nests, both of which, by the way, were only about 3 or 4 feet from the ground, and seeing a couple of families of the Red-flanked Bush-robin (*Ianthia rufilata*). Once a flock of Snow Pigeons (*Columba leuconota leuconota*) went hurtling past within easy range, but I was empty-handed, and had to content myself with admiring their beauty of form and flight.

Walking once more by the river's edge, I saw many Brown Dippers (*Cinclus pallasii tenuirostris*) and eventually disturbed a pair of Plumbeous Water-robins busily engaged in supplying the wants of a nestful of chicks. This was in a most unwonted situation, being not less than 50 yards from the water, and at least 15 feet from the ground in a hole in a tree. As if wishful to show that the exception proves the rule, the parents were void of all caution, and even went on feeding their charges while I was photographing the situation.

Above this, about 10,500 feet, I don't remember meeting with this species again, but White-capped Redstarts (*Chaimarrornis leucocephala*) were numerous, and appeared to have nests to judge by their actions when one commenced searching likely spots. However, I was unsuccessful as far as they were concerned, until, in the very last copse through which I passed, I saw one enter a stump with a piece of building material in its bill. The nest was almost completed, only requiring to be lined.

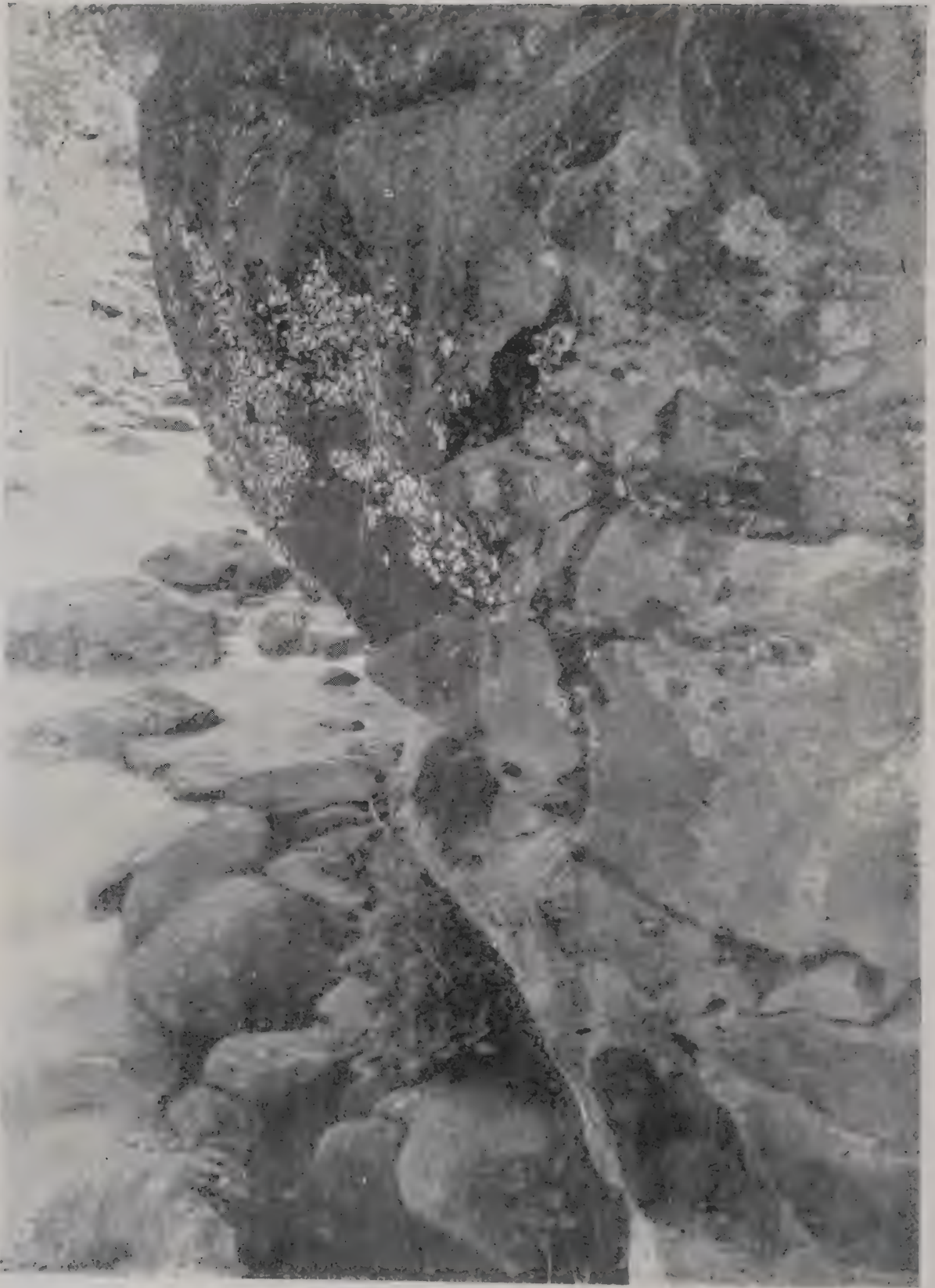
It was now pretty late, and I had still a couple of miles to go to reach the glacier, so nesting operations for the day perforce ceased. Even as it was, I did not reach camp again until well after dark, feeling pleasantly tired after being on the move for some 10 hours with but a short break for a picnic lunch.





HODGSON'S PIPIT (*Anthus roseatus*).





THE HIMALAYAN WHISTLING THRUSH (*Myiophonus horsfieldi temminckii*).

After leaving Liddarwat, Aru was my next halting place. This was a charming little village surrounded by considerable cultivation and open park-land. A short but wide side valley harbouring a mountain torrent of the same name provided the necessary space, rendering possible the village's existence, which incidentally was the first I had encountered since leaving Koolan.

I took up my quarters by the stream and some half mile from the village. There was now a decided difference in the heat of the sun, as the bed of the valley was rapidly dropping, and I found myself eager to take advantage of any shade that offered itself. As I was thus idly watching from the shelter of some bushes the last remnants of what must once have been a large snow drift, being rapidly eaten away by the fast flowing water, a female Plumbeous Water-robin flew down from a cleft in the rock a short distance away and commenced quietly feeding on the wet boulders in midstream. Apparently she never saw me sitting motionless in the deep shadow. A few minutes later the male, who had all the time been feeding a little way away, came downstream and joined her, and the two played about together for upwards of half an hour, after which the female flew up to the nest and the male returned to his former and evidently favourite feeding ground. I remained watching the whole morning and not once did the male go to the nest. The female once again left her post for a short period to snatch another hasty meal.

It thus dawned on me, why I had previously been unable to find the nest of this species except by chance. How many dozens of times had I seen pairs of them playing about the water's edge with seemingly no cares and nothing to do but enjoy themselves the live-long day. These I had left alone or watched for but a short time, but when I had espied a solitary male I had said to myself, "Now surely his lady is sitting, so soon he will take food to her." The result was that after watching him (through glasses as a rule) till my eyes ached, I reluctantly gave up the struggle and the riddle remained unsolved.

It is apparent that the male does not take food to his consort, but she, when she thinks the coast is clear, leaves the nest and fends for herself, and being of a cautious disposition does not return again, until she is pretty certain that she is unobserved. Hence I counsel as follows—watch the females or even the pairs, making certain you have not been spotted, but it is a waste of time to concentrate on a single male.

Half a mile up stream I had the opportunity of putting the above into practice, with the result that I found another nest in much the same sort of situation as the first. It was a difficult nest to get to, and entailed a wetting, so I left it alone. The first nest held four hardset eggs.

Another interesting problem was solved that day, as far as I am concerned at any rate, though I am open to correction, if I have drawn too hasty a conclusion. By the end of May I have found many evacuated Himalayan Whistling Thrushes' (*Myiophonus horsfieldi temminckii*) nests, and during this trip too I had noticed numerous young birds about. I now found within a few yards of one another two nests, one soiled, and evidently finished with, the other containing two quite fresh eggs. Not far away were two more nests, as before one given up, while the other, overhanging the water as usual, was clean and tidy but as yet empty. Before leaving Aru, however, it contained eggs, which unfortunately met with a tragic end. I photographed it from a bank, which slightly overlooked it, but was unable to see how many eggs it contained. It was too high up to get to from the ground, so Habiba, the aforementioned shikari, climbed onto a coolie's shoulders, and was thus just able to reach it with a stretch. The stretch proved fatal. He lost his balance, and in an attempt to save himself clutched at the rock-face. His fingers closed on the edge of the nest. The agony was not prolonged. A bedraggled shivering wretch (the water was icy cold) was soon ashore, but the nest and some broken egg-shells were being swept rapidly seawards.



However to return to my guns. After leaving Aru, I observed three more nests in each case with the bird sitting. Two were inaccessible; the third was still empty. Though it was now the second week in July, it was evident that the great majority of birds were laying. It, therefore, seems to me more than probable that the Himalayan Whistling Thrush has two broods in the year, the first about April, the second about July.

The nest of this species is a massive well constructed cup of moss grass and roots lined with finer grass, and is invariably placed on a ledge or the side of a boulder, and always close to the water. Often a nest is seen on such a narrow or sloping shelf, that it seems almost to be defying the laws of gravity, but it will be found to be firmly fixed, being more or less cemented to its bed by the dried mud amongst the moss of which it is composed. They are not as a rule far above the water, but I remember once noticing one on the opposite side of a narrow and immensely deep gorge, which could not have been much under 200 feet above the torrent below. They are fine looking birds, black with glistening light blue tips to the feathers of the neck and breast. These spots, however, are only visible at close quarters. Thus at a distance they closely resemble the Blackbird, being of the same clean build and also having a yellow bill. They are, however, considerably larger, an adult male attaining a length of some 13 inches. They have a large variety of notes, a pleasing song, and are also excellent mimics. At times, however, especially when in attendance on a family of youngsters, the many noises they produce, the volume thereof, and its unceasing flow are enough to get on the strongest of nerves. The eggs are greyish, more or less covered with very light brown specks, and are rather elongated. The shell is hard, slightly pitted and glossy. They average about 1.4" by 1", and 3 to 5 are laid.

On leaving Aru I noticed a Kashmir Cinnamon Tree Sparrow (*Passer rutilans debilis*) carrying material to a hole in a gnarled tree-trunk, while on the next tree a Kashmir Wryneck (*Iynx torquilla japonica*) matching the bark to perfection, was hunting for insects.

Some two miles above Pahlgam, while walking across a patch of shingle, a Hodgson's Pied Wagtail (*Motacilla alba hodgsoni*) flew from under a large stone at my feet. A nest was disclosed containing 5 eggs, which on testing one of them in the river, turned out to be quite fresh. This rather surprised me, as by the end of May practically every nest I found contained young ones. Possibly this was a second brood, or they may have been unlucky in previous attempts to raise a family.

Just after leaving this nest, I disturbed a Western Spotted Forktail (*Enicurus maculatus maculatus*), feeding at the edge of a small stream, which flowed across the path.

I had just come to the conclusion that this day's operations were over, as I was now approaching Batakot, where I intended staying the night, when a soberly coloured little bird—evidently a female chat of some kind—caught my eye. It was fussing about a branch but a few feet away from the path, with what looked like a caterpillar in its bill. I walked on watching it out of the corner of my eye, and had the satisfaction of seeing it fly to a deodar, and from there to a scraggy wild rose at its foot. I was unaware of its identity, so remained where I was, and was soon rewarded by the advent of the male, who, I was glad to observe, was doing his fair share of feeding his offsprings. It was a Dark-grey Bushchat (*Oreicola ferrea ferrea*). For a moment one almost mistook it for a shrike of some kind, as it has a decidedly long tail, is black above, and white below with a white wing patch and a white line above the eye, altogether giving it a most shrike-like appearance when in flight. The nest was a scanty contrivance of grass with a few feathers for lining, and contained three newly hatched downy chicks.

I was in the act of photographing this nest, when another female of the same species flew down into the roots of a hazel some 30 yards distant, so when I had finished, I transported my camera to this spot and here discovered a nest containing 4 eggs. They were on the point of hatching, one being already chipped, and a second showing signs of a slight ridge, where the file on its occupant's nose was already working through. The eggs were typical Bushchats, blue green with reddish markings mostly at the large end, and measured about .7" by .55".

This to all intents and purposes finished my outing, as I spent the next day walking hard, covering the 19 miles to Khanibal, where I found the Houseboat awaiting me. 36 hours later I was in the post office in Srinagar, where I was rather annoyed to find that a telecentric lens, that had been on order for the best part of a year, and which might have been useful on one or two occasions, had arrived the very day I left for the Sind Valley.

I had had a most interesting 18 days, very successful too, when one takes into consideration the fact that I was on the move practically every day, and this is by no means conducive to success. One will invariably find far more by stationing oneself in a likely spot and observing with glasses, than by any amount of actual searching on the march.

Still who could have wished for a pleasanter holiday than this. These valleys of Kashmir are indeed an ornithologist's paradise. Combined with an ever changing mass of bird-life, one has before one's eyes the finest scenery in the world. Here are unfolded great sweeps of forest-class hillside; there vivid green slopes, dotted with the herds of wandering gujars. Again immense dark chasms present themselves, in the gloom of which foaming torrents deafen one with their ceaseless din, while above all, touching the very vault of Heaven, gigantic tumbled masses rear their snow-capped heads through the billowing clouds. Oh! to watch again of an evening from one's tent door the deepening shadows in the valley below, and the ever-changing kaleidoscope of rainbow colour thrown by the setting sun on the glistening snows above, while recalling at leisure the events of a successful day. May it be soon!

(To be continued.)



OBSERVATIONS ON THE BREEDING HABITS OF SOME FRESH WATER FISHES IN THE PUNJAB.

BY

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(With two plates.)

The observations on the breeding habits of *Cyprinidæ* and *Siluridæ* were carried on in their natural spawning grounds from 1921-1923, while of *Ophiocephalidæ* were recorded from Departmental ponds at Madhopur and Sirkian. The measurements and weight of gravid females were taken and the total number of eggs obtained by weighing the whole mass and then weighing a small portion carefully and counting it as a basis for a calculation.

Species of fish.					Weight.	Number of eggs.	Number of eggs per lb. (40 tolas) of weight.
					Tolas.		Approx.
<i>Labeo rohita</i>	..	..	..	..	410	19,05,000	1,85,854
<i>Labeo calbasu</i>	..	..	..	..	120	4,86,600	1,62,200
<i>Labeo calbasu</i>	..	..	..	..	160	7,39,400	1,84,850
<i>Labeo gonius</i>	..	..	..	..	18	2,900	6,444
<i>Labeo microphthalmus</i>	..	..	..	..	19	3,400	6,105
<i>Cirrhina mirgala</i>	..	..	..	..	132½	2,16,800	65,450
<i>Cirrhina mirgala</i>	..	..	..	..	80	1,24,800	62,400
<i>Cirrhina reba</i>	..	..	..	..	17	3,200	7,530
<i>Catla catla</i>	..	..	..	..	452	4,00,275	35,378
<i>Rita rita</i>	..	..	..	..	40	20,800	20,800

Determination of the reproductive powers is not only useful from a theoretical point of view but it is of immense importance in the practical question of fish culture. The extraordinary fecundity of fish is remarkable, though it varies in different species, and this fact if properly considered by the pisciculturist, will lead him to devise means to increase the production of fish by protecting the eggs as well as by shielding the young and helpless fry from the many dangers which threaten them.

In the "Natural History of British Fishes" by Buckland many instances are given of the number of eggs found in gravid female fish. A few of these selected by Dunsford (1) are given here for comparison with the Punjab Fish.

Species of fish.					Weight.	Number of eggs.	Number of eggs per lb.
					lbs.		
Carp	..	..	..	..	14½	6,33,350	43,679
Carp	..	..	..	..	21½	13,10,750	60,965
Carp	..	..	..	..	16½	20,59,750	1,24,833
Pike	..	..	..	..	35	43,000	1,228
Pike	..	..	..	..	24	2,24,640	9,360
Cod	..	..	..	..	20	48,72,000	2,43,600
Trout	..	..	..	..	1	1,000	1,000

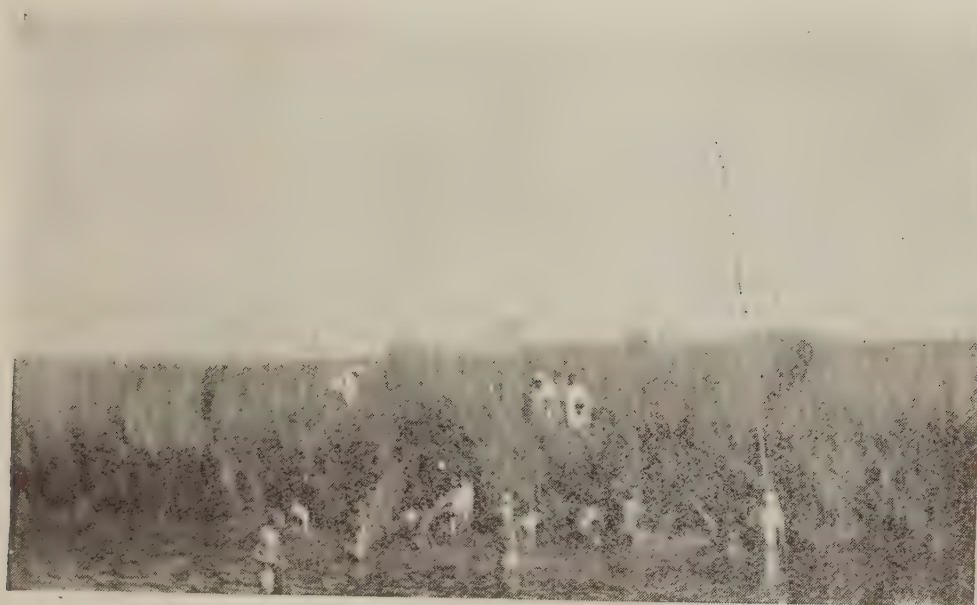


Fig. 1. NETTING FOR MURREL.

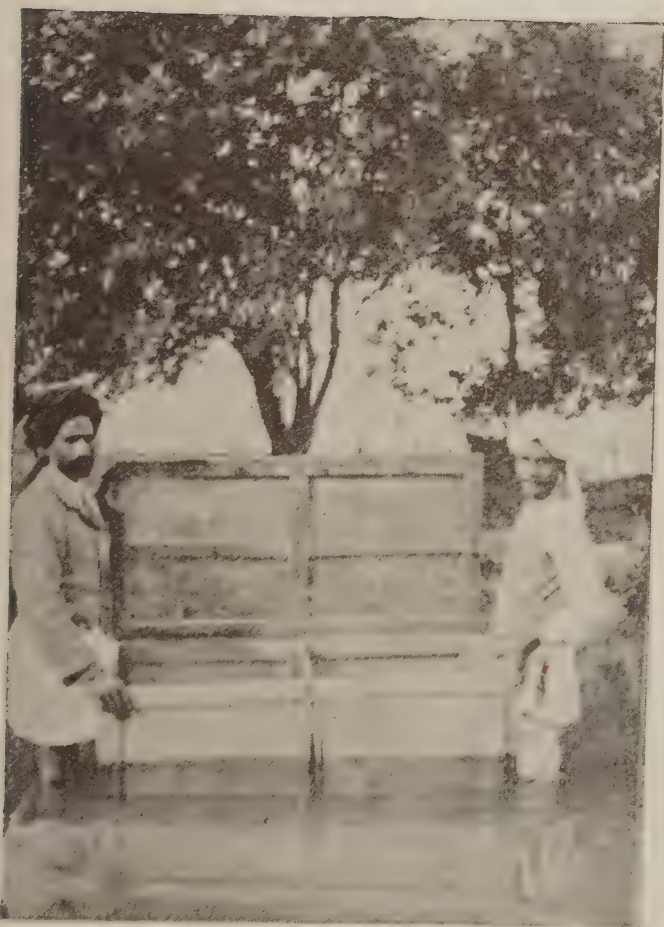


Fig. 2. Live Car for keeping Eggs and Fry under observation at Hatcheries.



Fig. 3. Tank at Sirkian for Murrel (*Ophiocephalidae*) breeding.





CHHENAWAN FARM FOR CARP BREEDING.

1. Stock pond for breeders.



CHHENAWAN FARM FOR CARP BREEDING.

2. Stock pond for young fish.

All attempts to breed the members of the family *Cyprinidae*, namely, *Labeo rohita*, *L. calbasu*, *Cirrhina mirgala* and *Catla catla* in artificial waters have proved failures. Unlike their western species they do not lay their eggs, even when brood fish from the river are introduced into the tanks. The experiment was tried at the Departmental Hatcheries at Madhopur but no result was obtained. One of the main reasons for our failure is the want of knowledge of their-breeding habits in their natural environments.

The fish become ripe in May and both male and female seek shelter under weeds and aquatic plants near banks and are not easily frightened by the approach of intruders. Towards evening, groups of fish may be seen on the surface splashing water and fighting with each other. These are signs of courtship ! And thus they wait for the first shower of rain. If there are no rains at all, or if they are late, the eggs degenerate in the ovaries, leaving a filthy mass. In July as soon as the rains set in, the streams become flooded and the fish move on to shallow waters. If the flood is of a temporary character they fall back into the main channel with the diminishing current without spawning, but if the floods are continuous the fish get into the surrounding fields, play together, lashing the water with their caudal portions. A female is often followed by three or more males, but reverse cases have also been observed. Very rarely are single couples seen. If a mate is separated from its companion or is companionless it has been heard to produce guttural sounds calling the other. This play lasts for only a short time and the female then lays its eggs which are non-floating and the males shed their seminal fluid or milt over or near them. Depth of water in fields where spawning takes place varies from three inches to two feet, and temperature of water ranges from 76° F. to 98° F. Sometimes when the flood subsides earlier, little pools are formed by the depressions and there the eggs are found in heaps.

The eggs are not laid at one place and at the same time, but at intervals during which the fish keeps on moving with its mates along with the current of water. The rivers are flooded first and the fish therein are the first to spawn, while those of the tributaries wait for heavy rains which flood them sufficiently to overflow into the fields where spawning takes place. The breeding time, thus, lasts from the beginning of July to the middle of August.

An egg measures from 1.5 m.m. to 2 m.m. but it swells to 4 m.m. as soon as it falls into the water due to the presence of a mucous like investment which gives it a glassy bead like appearance. The colour varies in different species : reddish in *Labeo rohita*, bluish in *L. calbasu* and *L. gonius*, light red in *C. mirgala*, dirty white in *C. reba* and yellowish in *Wallago attu*. Milt or male fluid is milky white, non-sticky and non-granular. The development is quickened by the warmth of the sun falling directly on the eggs lying in shallow waters and unlike their western species which hatch out toward the 12th or the 16th day, the embryo is seen bursting the eggs after 30 to 40 hours from the time of laying. There is very tiny yolk bag which is absorbed in three or four days. The mouth opens on the third day after hatching for respiration and two days after this, the young fry begin to seek their food in the diminutive pools where they have been left by their parents.

The extraordinary fecundity of these fish which is unparalleled in animal life is attended with enormous waste. The eggs are laid during floods which may carry them to places where their fate becomes uncertain. The male sheds its milt in water and there are very big chances of an egg being left unfertilized. The eggs either sink to the bottom or rest on grass attached by their gelatinous coats and there is every likelihood of the spawning fields drying up before they are hatched. If, however, they are lucky enough to escape all these misfortunes and are hatched in due time and find opportunity to run into a pool or stream, there their enemies do not leave them unmolested. Eggs of *Wallago attu*, a predaceous Siluroid and *Labeo gonius*, were collected from the same spot. They



hatched out at about the same time, but after a week the fry of *Labeo gonius* was 7 m.m. long while that of *Wallago attu* 20 m.m. and the latter were chasing the former and devouring them in large numbers; their mouths being big enough to catch two of the *Labeo* at a time. The rate of growth of *Wallago attu* fry is much faster than that of the Carp. In the latter the mouth opens twenty-four hours after hatching for respiration and the gut is completely formed after seventy-two hours. In *Wallago attu* the mouth opens within less than twenty hours and the gut is complete within forty hours after hatching and the fry begin to devour whatever comes in their way.

Even with such a loss and destruction of the eggs and fry the waters would teem with the finny tribe so long as man did not interfere with their normal growth by indiscriminate and untimely slaughter. The killing of one gravid female would mean the destruction of hundreds and thousands of eggs which otherwise under the most unfavourable circumstances would develop to continue their progeny. Observation of close season for fishing during breeding time will help the matter much, while establishment of hatcheries on scientific basis near the spawning grounds will ensure the development of eggs and fry and lessen the chances of their loss and destruction.

*Barbus tor* (Mahsir) differs from other members of the *Cyprinidæ* in as much as it is migratory in its habits. *Barbus tor* is seen in March and April ascending considerable heights and traversing long distances to get into the hilly tracts for spawning purposes. It has been said that these fish ascend to these hilly streams to find fresh feeding grounds or shallow waters best suited to the puny strength of their fry when hatched, and also that the parent fish drop back with the decreasing water, and therefore cannot return to devour their fry which are completely cut off till the next rainy season. But all this is true in a way regarding every other *Cyprinidæ* which spawn in the plains: therefore what accounts for the migratory habits of *Barbus tor*? In the case of Salmon, Roule (5) remarks "the habits of salmon are largely determined by the amount of oxygen dissolved in water. During the spawning season Salmon need the respiration intensified and therefore select and ascend rivers in which there is satisfactory proportion of oxygen." L. Crosswell commenting on this paper says "Salmon are driven to seek the gravel beds of the upper reaches of rivers, and trout the gravel beds of the lesser tributaries for spawning purposes, not only by their natural thirst for oxygen or their need of it in intensified respiration, but that their desire for the freshly aerated supply of water afforded by downward rushing mountain brooks, streams and rivers is fundamentally associated with the need of oxygen in oval development in and after spawning." He supports his statement with conclusions drawn from Loeb's experiments on artificial parthenogenesis, where fertilisation was initiated and development carried to the larval stage by means of cortical cytolysis followed by acceleration of oxidation in unfertilized eggs of molluscs and amphibians. Loeb came to the conclusion that the essential effect of the entrance of a spermatazoan into the ovum is also an acceleration of oxidation. Here is, then, the importance of oxygen in relation to the spawning of fish and the development of fry. Rapid flow of water brings volumes of oxygen in the downward rushing streams and *Barbus tor* travels up to get them. These fish were introduced into the ponds at Madhopur, but notwithstanding the submontaneous character of the place, they did not spawn as no rushing currents of water during rains stimulated them to lay their eggs.

In India pisciculture has almost been wholly neglected and in the Punjab it has never been seriously undertaken. The fecundity of fish is an established fact and the truth of this has been recognised in foreign countries where accordingly scientific methods have been devised to carry on fish culture. Study of the breeding habits shows that the Indian Carp can be made to spawn in ponds and tanks provided that all the conditions of their natural spawning

grounds are taken into due consideration. A current of running water, flooded area during rains, escape of flood water into adjoining fields will, undoubtedly, result in stimulating the fish to spawn.

Members of the *Ophiocephalidæ* have successfully bred in artificial waters ; and they are mainly tank fishes. The enormous production of eggs in *Cyprinidæ* and *Siluridæ* is in adaptation to their environmental conditions which allow hardly one out of thousand eggs to develop, while in *Ophiocephalidæ*, formation of nests, parental care and absence of floods play a great part protecting the small number of eggs—two to seven thousands—which are laid before the rains set in. The observations recorded here were made at the Departmental Hatcheries on *Ophiocephalus marulius* mainly and *O. gachua* and *O. striatus* occasionally.

Nest building of *O. striatus* of Ceylon has been described by Willey (6), and of *O. striatus* of Mysore by Day (9) and of *O. punctatus* of Madras by Wilson. *Ophiocephalus marulius* makes its nest amongst aquatic plants and in spots where there is abundance of food for young fry. Just before the eggs are laid the fish may be seen swimming towards the banks and hiding themselves under vegetation : they are seen in pairs. A pair is often seen to frequent only one place, where later on the nest is made by means of cut portions of weeds which the fish break or uproot with their mouths. It takes at least a week to build up a nest : which is merely a receptacle for the eggs without any elaborate passages for ingress or egress of fish ; and both male and female take part in its construction.

Process of spawning has been observed in *Ophiocephalus gachua*. The pair lies submerged in clear, but stagnant, water without any nest or receptacle. The female has its ventral surface directed upwards, while male lies crosswise over it. Their genital pores are thus close together. Two to three hundred eggs are liberated at a time at an intervals of a minute or two, and the fish remain in the same position, and at the same place till all the eggs have come out. The male pours its milt at the same time. Eggs rise to the surface, spread there and float. The fish use their fins all the time to keep their balance.

Eggs in *Ophiocephalus marulius* are floating, circular, light, reddish yellow and non-adhesive. There is a single large oil globule in the yolk which makes the egg bouyant. Each egg measures 2 mm. There is no gelatinous covering. The embryonic development goes on rapidly, but depends considerably on the temperature of water. The eggs hatched out in fifty four hours at temperature 61° to 79° F and in thirty hours where the temperature ranged from 83° to 92° F.

The breeding season of *Ophiocephalidæ* in the Punjab lasts from the middle of April to the end of July. The fish guard their fry for about a month or so. In the case of *O. marulius* six weeks old fry do not keep together and probably when the fish find its young ones have become disobedient and have begun to wander about, it begins to devour them.

Whether it is the male or female that guards the nest is an open question. The female has been frequently seen just beneath the eggs and fry, keeping strict guard over them and is easily recognised by its large size. The male keeps watch at a short distance, and whenever the nest is approached, the male runs away causing a splashing noise which warns the female. The female does not run away immediately but keeps looking at the intruder and withdraws herself backwards slowly, keeping an eye on the nest at the same time. The positions of male and female are very often reversed. For full one week the fry remain in the nest, and then the parent fishes take them along with them. The fry sometimes separate into several groups, but the parents stay at one place and each group comes back as though they have been ordered to do so. In one instance the parent fish jumped a foot clear out of water after a kingfisher, which after taking a fry had flown to a branch of a tree a yard



above the surface of water. When the fry grow big and are too numerous to be guarded by the mother alone, they split up into two groups, one guarded by the male and the other by the female. The fish at this stage when approached would either hide itself under its young ones or would leave them very reluctantly, going not far off, and returning soon after the intruder had gone away. A pair of *Ophiocephalus gachua* were once seen in a pond with a few days old fry. The male swam immediately below the swarm while the female was at a little distance off. Positions were, however, frequently reversed, and the female as often remained below while the male kept watch on one side or the other, swimming round and round. Two *Belone cancilla* made their appearance, evidently attracted by the fry, but were met with by the angry eye of the mother. Both intruders came to a halt and remained as motionless as *O. gachua*, and a staring match ensued : both being absolutely motionless for the space of quite a minute or more, though not nine inches of water divided them. At length a very slight fin movement of *O. gachua* sent her slightly forward and like a flash both the *Belone cancilla* turned about and made off, while *O. gachua* returned to her brood. Both the *Belone cancilla* were considerably longer than the *O. gachua* which sent them about their business.

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# A DESCRIPTION OF THE NESTS AND EGGS OF THE COMMON BIRDS OCCURRING IN THE PLAINS OF THE UNITED PROVINCES.

BY

E. H. N. GILL.

PART IV.

(With a plate).

(Continued from page 768 of this volume.)

<i>Motacilla maderaspatensis</i> (831) ..	The Large Pied Wagtail.
Local name .. .. .	Bhuin Mamula.
Anglo-Indian name .. ..	The Common Wagtail.

This is a familiar bird in the well-watered tracts of the western districts, and of all the numerous species visiting us in the winter is the only one which remains behind to breed. I have never seen the birds East of Benares, and I very much doubt whether they occur in the Eastern Districts at all.

On the Ganges and Jumna, and various other streams and swamps in the Western Districts the birds are common, and are met with either singly or in pairs in the immediate neighbourhood of water, from the surface and by the side of which they procure their sustenance. They are resident throughout their range practically all the year round, and are seldom absent from the vicinity of their breeding grounds.

The period of nidification is from about March to May—quite a short one. Both birds assist in building the nest, and if watched carefully will soon lead one to the selected spot. The sites chosen for these nurseries are influenced to a great extent by environment, so that in the Bundelkhand streams, those with rocky bottoms, the nests are invariably placed in holes and crevices in rocks quite close to the water; whereas on the Jumna and Ganges the most favoured sites are pontoon bridges, the nests being carefully tucked away in some nook or corner of an old boat or iron pontoon, in which circumstances the birds evince no fear of man whatsoever. On tanks and marshes old disused boats are often appropriated, the nests being hidden away under the gunwales; while holes in the walls or drain pipes of old buildings in the vicinity are also favoured. In the Jhansi district there is a weir across the Dassan river which contains an arcade of considerable length. Inside this arcade little alcoves have been let into the wall at frequent intervals, and on one occasion I found about a dozen nests in these alcoves all of which contained eggs. It will therefore be seen that the building sites selected by these birds are by no means limited, and not confined to any particular locality; and, as Hume puts it, "It is impossible to generalise satisfactorily in regard to the nidification of such irregularly-minded birds as these".

The nest varies in size and structure in accordance with the position in which it is placed. The choice of building material is also unlimited—fine twigs, grass-stems, wool, old rags, hair and tow, and various coarse vegetable fibres being freely used; and while some nests are frail and delapidated with only a slight depression in the centre to contain the eggs, others are strong and substantial with a well-formed and deeply cup-shaped egg-cavity in the middle, neatly lined with horse-hair and soft vegetable fibres.

The normal number of eggs is four, occasionally five, and often only three. In shape they vary considerably, but are typically moderately long ovals more or less pointed towards the small end. In regard to colouring they are, as a whole, of two distinct types. In one the ground-colour is a greenish white with markings of slightly darker shades, and in the other a dull white with dingy brown markings; and between these two types intermediate varieties varying in



tone and character of the markings occur quite commonly. The markings consist of spots, specks, clouds and smudges, in some more some less, some times bold and distinct and sometimes so confluent as to almost obscure the ground-colour altogether. In fact the variation is so considerable that a reliable description is almost impossible. A normal specimen would measure about 0·9 by 0·6 inch.

<i>Alauda gulgula</i> (861)	..	..	The Indian Sky-Lark.
Local name	..	..	Bhurut.
Anglo-Indian name	..	..	The Sky-Lark.

This bird seems to be pretty evenly distributed throughout the alluvial tracts of the Province, and is at once recognised by its pleasing song uttered while on the wing. It is met with either singly or in pairs, and seems to prefer wild open country; usually avoiding anything in the nature of heavy grass or forest.

The breeding season seems to be from about April to the end of June, but the birds, being terrestrial in their habits, are wary and suspicious; with the result that the nests are, as a rule, rather difficult of location; and on account of the remarkably protective nature of their colouring, the birds are capable of seeing without being seen; a fact which renders careful observation somewhat difficult.

Broken country interspersed with stubble, patches of stunted tamarisk and camel-thorn, with perhaps a stunted acacia here and there, are ideal nesting places; but even though the birds may be seen to frequent particular spots the nests will not be revealed till after diligent search, and very often not at all.

If the birds are busy constructing a nest they will always be on the lookout for intruders. Consequently the observer, though he may have concealed himself at a respectful distance, has probably made his presence known long before he got there. He wonders then how it is that he is unable to detect the position of the nest. He sees a bird descend at a certain spot with building material in its bill, he watches it leave the same spot with its bill empty, and yet a careful search reveals no nest. He returns to his observation post and again watches the same farce enacted; perhaps in the same spot, perhaps in several others. But this does not bring him any nearer the nest, nor afford the smallest clue to its whereabouts. Eventually he gives the business a miss in baulk, and goes away thoroughly disgusted;—a sadder but not a wiser man.

What actually happens is this. Though the birds may be quite aware of the presence of a stranger, his mere presence, provided he is not too close, is not sufficient to deter them from the more important work of reproduction. Consequently building operations are continued in the usual way; but with fiendish persistence the birds contrive to put the watcher off the scent by descending with building materials quite near the latter, but at some distance from the nest. Then, watching their opportunity and taking advantage of every conceivable bit of cover, they worm their way to the nest, and, after fixing the material in the desired position, worm their way back to the position from which they started before flying off again.

Practically the same procedure is adopted when the eggs are laid and incubation is in progress. The sitting bird will leave the nest on the approach of a stranger if it can possibly do so without being detected, and will travel some distance along the ground before rising into the air. But if caught napping—not a common occurrence—it will sit tight and trust to its colouring to escape observation. In these circumstances it is often flushed, and the nest is then revealed. Ordinarily the nests are found purely by accident, but the majority escape detection altogether.

The nest is always placed on the ground in a hollow scraped up by the birds themselves, sometimes under a stone or clod of earth, sometimes under or at the roots of tufts of grass, and sometimes at the base of some stunted bush. Sometimes it is a deep and sometimes a shallow cup, built into the hollow with

the rim only slightly protruding above, and composed of fine grasses, roots, and stems with the egg-cavity carefully lined with much finer material; and both birds assist in its construction.

Five is the full complement of eggs laid, but it is more usual to find three occasionally four. In shape they are typically moderately elongated ovals, sometimes a good deal pointed towards one end. The ground-colour varies from a greyish to a yellowish white with a moderate gloss; rather densely freckled, spotted and speckled, sometimes blotched, with various shades of dingy yellow and pale purple. Some specimens are almost inseparable from those of the Common Sparrow, and a normal egg would measure about 0·8 by 0·6 inch.

*Alaudula raytal* (866) .. .. The Ganges Sand-Lark.

Local name .. .. Unknown.

Anglo-Indian name .. .. Unknown.

This inconspicuous though sprightly bird is commonly distributed throughout the Eastern and Western districts alike, but seems to be confined almost exclusively to the undulating sandy dunes of the Ganges and other large streams. Its habits are the same as those of the other allied species, save that it is not much of a songster, and is perhaps even more terrestrial than the last species. Straggling patches of tamarisk, camel-thorn, and other deep-rooted fungi, common along most sandy dunes, are favourite nesting places; but here again the protective colouring of the birds renders the detection of their nests very difficult.

The breeding season is from about March to May, and the nests, though similar in structure to those of the last species, are much smaller; being about three inches across and placed, as a rule, at the roots of tamarisk and camel-thorn bushes, or under tufts of grass; grass-stems, roots, and dry tamarisk leaflets being freely used in the structure.

The full complement of eggs is three, though normally only two are laid. In shape they are typically rather perfect ovals, slightly compressed towards one end. The ground-colour is a yellowish or greyish white with a moderate gloss. The markings are peculiar and characteristic and consist of a mass of minute speckles of a slightly darker shade scattered profusely all over the egg, and only very occasionally presenting secondary markings of pale purple shades. A normal egg would measure about 0·7 by 0·5 inch.

*Mirafra cantillans* (869) .. .. The Singing Bush-Lark.

Local name .. .. Aghun, Aghin.

Anglo-Indian name .. .. Unknown.

This species seems to be locally distributed in some portions of the Province, and is totally absent from others. In habits and coloration it greatly resembles the Red-winged Bush-Lark, but its song is unmistakable. The two species are, however, much confused by the amateur.

The birds are found in wild bushy country, and several pairs may be seen frequenting the same locality, flitting about the bushes to the accompaniment of those quaint plaintive notes so characteristic of the species.

The breeding season is from about March to August, and the nests, invariably placed on the ground amidst thick grass and well concealed, are of two distinct types—a peculiarity for which there is no accounting. One is just the typical lark's nest as already described, and the other is more or less dome-shaped with the eggs completely concealed from view. It is composed of dry grasses and roots and is, in fact, a perfect miniature of a Coucal's.

Four appears to be the full complement of eggs, though three is more usual. In shape they vary a good deal, but are typically rather long ovals, somewhat pointed towards one end. In colouring and character of the markings they resemble certain types of Sparrow's eggs, but in some specimens the markings present a reddish brown tint by which they can be differentiated. A normal egg would measure about 0·7 by 0·5 inch.



<i>Mirafra erythroptera</i> (871) ..	..	The Red-winged Bush-Lark.
Local name .. ..	..	Jungli aggia.
Anglo-Indian name .. ..	..	Unknown.

This is the common Bush-Lark of the Province, and is met with in most suitable localities. Its habits and particulars of nidification are identical with those of the last species, even to the extent of constructing two different kinds of nests. The eggs, however, are remarkable for the uniform speckly character of the markings, and the distinct red and reddish brown tints which predominate in all the eggs, and which, in many cases, have a tendency to collect in an irregular cap or zone at the large end. The eggs approximate in size to those of the last species.

<i>Galerita deva</i> (875) ..	..	..	Sykes's Crested Lark.
Local name .. ..	..	..	Chandul.
Anglo-Indian name .. ..	..	..	The Crested Lark.

This species occurs quite commonly in suitable localities throughout the Province, particularly in the drier and cultivated tracts. Their pale colouring and small perky crests are unmistakeable, but they do not seem to have acquired the soaring habit of the Indian Sky-Lark. They are, however, adepts at evading observation themselves and leading intending robbers away from their nests, and invariably evince the same cunning as the Indian Sky-Lark.

The period of nidification is from about June to August, and the nest is always placed on the ground in dry and open country. It is invariably built into a small hollow or depression sometimes almost entirely concealed by some clod of earth, or hidden away amidst a tussock of grass, or at the roots of some stunted bush. It is composed of various grasses and vegetable fibres usually without any lining whatsoever; measuring about 4 inches in diameter and  $2\frac{1}{2}$  inches in height.

The eggs, usually three in number, vary considerably in shape, size and coloration; but typically are broad ovals, slightly pointed towards one end. The ground-colour varies from a dull yellow to a greenish white and exhibits a brighter gloss than any of the other species. The markings consist sometimes of a multitudinous collection of freckles of purple shades, and sometimes of spots and freckles of reddish brown underlaid by pale purple clouds particularly towards the large end; some eggs bearing a remarkable resemblance to those of the Brown-backed Indian Robin. A normal egg would measure about 0.7 by 0.6 inch.

<i>Pyrhulauda grisea</i> (879) ..	..	The Ashy-crowned Finch-Lark.
Local name .. ..	..	Diyora, Duri.
Anglo-Indian name .. ..	..	The Black-bellied Lark.

This is perhaps the commonest species in the Province, and occurs in almost every district in suitable localities. The birds seem to be more or less gregarious in their habits and are usually met with in parties of a dozen or more, frequenting dry open plains and undulating uplands. Their colouring is of a highly protective nature with the result that they will usually allow one to approach to within a few feet without being alarmed. They are much the smallest of the species already described, and the males can easily be recognised by their black underparts and the light grey patches on their heads.

The males of this species evince a curious habit of soaring into the air at frequent intervals, rising and falling in rapid undulations, and then descending to earth in a fast nose dive, sometimes from considerable heights. This curious practice is more pronounced in the breeding season and has doubtless something to do with it, though to the casual observer it would appear to have no meaning whatsoever.

The period of nidification is from about July to August, according to locality, though I am unable to state definitely whether two broods are raised in this







NEST OF THE PURPLE SUN-BIRD IN A  
CACTUS BUSH.



NEST OF THE PURPLE SUN-BIRD  
(*Arachnechthra asiatica*).

period or not. The work of nest construction would appear in most cases to be undertaken entirely by the female, though the male doubtless assists in incubating the eggs and feeding the young. Nests may be found quite commonly on the ground on dry open plains or fallow fields ; a hoof-print frequently forming the cavity in which the nest is placed. Sometimes the nest is placed against a clod of earth, sometimes against the slender roots of camel-thorn, but is mostly right out in the open without covering or canopy of any description. The nest itself is merely a small, circular, more or less cup-shaped pad of various vegetable fibres and soft materials, about 3 inches in diameter and quite substantial. But on more than one occasion I have found eggs on the bare ground where there was not any sign of a nest, while Hume records having found a nest amongst the ballast, between the rails, where trains were passing a dozen times a day over the sitting bird ; and “ When we think of the terrific heat glowing from the bottom of the engine, the perpetual dusting out of red hot cinders, it seems marvellous how the bird could have maintained her position”.

The full complement of eggs is three, though one ordinarily finds only two. In shape they are typically moderately elongated ovals somewhat pointed towards one end. The ground-colour varies from a greyish to a greenish white, and the markings consist of speckles, spots, and mottlings of yellowish brown scattered over the egg. Some are remarkable for their freckled character, while in others the markings are hazy and indistinct, and yet so uniform and confluent in others as to obscure the ground-colour almost entirely. A normal specimen would measure about 0·72 by 0·55 inch.

<i>Arachnechthra asiatica</i> (895)	..	The Purple Sun-bird.
Local name	.. ..	Shakar khora.
Anglo-Indian name	.. ..	The Common Honey-Sucker.

The Purple Sun-bird, so often referred to as a Honey-Sucker, is very commonly distributed throughout the Province. It is a familiar and fascinating garden species, and is always seen frequenting certain flowering trees and shrubs from the blooms of which they extract the nectar ; fluttering and hovering about the blooms like gigantic honey-bees.

The male is unmistakeable on account of his brilliant peacock-blue plumage, but the female is not nearly so conspicuous. Her colouring is, in fact, distinctly sober ; so that the uninitiated might quite easily pass her by, or perhaps not identify her in any way with her sprightly and gaily-coloured mate.

The period of nidification seems to be quite an elastic one, for nests may be found, according to locality, in almost any month of the year. February and March, however, would seem to be the most favoured. The labours of nest construction, incubation of the eggs, and feeding of the young, are borne entirely by the female, while her retrograde mate disports himself gaily among the flowers, makes himself most objectionable to all feathered society in the neighbourhood, occasionally sitting near the nest and cheering his mate with loud and vigorous song, and is not above carrying on an outrageous flirtation with the wife of another elaborately-garbed gentleman in the next hybiscus patch if she so happen to pay him a visit within the limits of what he considers to be his boundaries. But where the reproductive faculty seems to have passed him by, it is certainly an overmastering desire with the female, who devotes herself to her arduous labours with a persistence beyond all praise. Not only does she evince a sense of ingenuity truly remarkable in the matter of architecture, but her eye for the picturesque is equalled only by her choice of protective environment, her unbounded devotion to the young, and the quixotic departures from the normal in the choice of peculiar nesting sites.

The nest is pensive and of very remarkable structure, conforming to a shape which I can best liken to an elongated pear ; the lower part, comprising the egg-compartment, being almost a perfect cup with the sides tapering gradually upwards to meet at the point of suspension. The choice of materials is practi-



cally unlimited, for anything soft and pliable, which can be woven with spider's web and silky materials into a compact nursery about 7 inches in height and 3 inches in width, is used for the purpose, and a perfect work of art is the result.

About midway between the point of suspension and the egg-compartment a small circular hole about an inch in diameter is worked into the nest fabric which operates as an entrance to the nest, and over which is worked a small canopy or portico, which is a characteristic feature of the construction.

From the point of suspension the nest is gradually extended and widened till the place where the aperture should be is reached; the nest having acquired, by this time the shape of a more or less solid cone with the apex on top. Now comes the aperture with the little projecting cornice above it, and the greatest care is exercised in its construction. Follows later the extension of the body of the nest, and finally the soft and cosy egg-compartment. Then follows a short period of activity during which the female may be seen going in and out of the nest, twisting and turning her little body about inside it in order to get the pliable materials to conform to the shape of her body; and, as she sits in the nest with her bill protruding from the aperture, it acquires a distinct bulge behind in order to accommodate her tail in comfort. This little habitation is completed in about ten days. Her food during the period of nidification is reduced absolutely to the minimum, for she is seldom away from the nest, and is not attended to at all by her mate.

Rather a remarkable feature of these nests is the dry leaves and rubbish which are stuck all round the egg-compartment, and also as streamers below it; which Hume and other observers ascribe purely to ornamentation. But I would suggest that a much subtler motive is intended. It is a curious fact (I speak purely from personal observations) that nests which are built in what one might consider abnormal positions—on punkah ropes or the wire netting across a window for instance do not ordinarily exhibit these untidy streamers to any appreciable extent. But those built in thorn and cactus bushes where rubbish and cobwebs abound are most elaborately decorated with these materials in order, presumably, to harmonise with the surroundings as much as possible. Protective mimicry or camouflage would therefore be quite a possible factor when contemplating the question of what others have been content to treat as mere ornamentations. I should imagine that the struggle for existence amongst these smaller species is sufficiently acute to preclude any idea of ornamentation where a more useful purpose might be served. Concealment and mimicry would ordinarily be the prime consideration.

Normally two eggs are laid, but one frequently finds three. In shape, size and colouring they vary considerably; but typically are moderately broad ovals, considerably pointed towards one end. The ground-colour varies from a greyish, through shades of greenish, to a brownish white. The markings consist principally of minute speckles of grey, pale purple, and brown shades pretty uniformly scattered over the whole egg, usually obscuring the ground-colour altogether, and invariably collecting in a confluent zone at the large end. The dull, ill defined and confluent nature of the markings is a characteristic feature of the eggs, and, in fact, quite unmistakeable. A normal egg would measure about 0.65 by 0.45 inch.

*Dicaeum erythrorhynchus* (919) .. Tickell's Flower-Pecker.

Local name .. .. . Unknown.

Anglo-Indian name .. .. . The White Honey-Sucker.

This little bird is commoner than is usually supposed. It is to be found in most districts in the Province, but on account of its inconspicuous colouring and small size quite easily escapes observation. In general appearance it is very like the female of the Purple Sun-Bird, though it is smaller, the bill much shorter, and the upper plumage suffused with a greenish tint. There is no mistaking the difference when the two species are seen together.

Though of such small size, they differ from the Purple Sun-Bird in one important particular in that they are seldom seen among bushes or shrubbery, but always on large trees for which they evince a curious attachment. They are met with either singly or in pairs, flitting nervously about the highest branches and are everlastingly on the move. Their very faint but high-pitched note repeated at intervals, is unmistakeable.

The breeding season is from about February to May, and the nest, always placed high up on some large tree, is one of the most difficult to find. The birds are extraordinarily wary, and I have seen several cases where they have deserted the nest altogether on account of the observers being careless and arousing their suspicions. Both birds assist in building the nest, and the male probably assists in incubating the eggs as well.

A considerable amount of attention is paid to concealment, so that the nest is invariably hidden away amongst a bunch of leaves. It is pensile, and in appearance is not unlike the Purple Sun-Bird's, save that it is much smaller, usually much rounder, and more carefully put together. The building materials are much finer, and the egg-compartment is most carefully lined with soft vegetable fibres and silky down, particularly silk-cotton from the pods of *Bombax malabaricum*. The external decorations and streamers of rubbish, as also the projection over the aperture, are almost entirely wanting.

Only two eggs are laid. In shape they are typically rather elongated ovals, more or less pointed towards the small end. The ground-colour is pure white and glossless without any markings of any description. A normal egg would measure about 0.6 by 0.4 inch.

<i>Piprisona squalidum</i> (921)	..	The Thick-billed Flower-Pecker.
Local name .. .. .	..	Unknown.
Anglo-Indian name .. ..	..	Bul-tit.

This interesting little bird occurs quite commonly in almost every district in the Province, and, like Tickell's Flower-Pecker, evinces a curious liking for large trees; seldom or ever frequenting bushes or shrubbery. In size and colouring it resembles greatly Tickell's Flower-Pecker, but its note is quite different and characteristic; being a succession of loud *tics* uttered both whilst feeding and during flight. The bill too is much shorter, and when looked at from above forms a complete equilateral triangle. The birds are met with either singly or in pairs, and are everlastingly on the move; never resting for a single moment.

The breeding season is from about February to June, though the bulk seem to breed in March, and the nest is so typical that when once seen it can never be mistaken for any other. They are always placed on large trees, sometimes low down, but invariably at considerable heights from the ground; and a great deal of importance is attached to concealment.

The nest is composed throughout of extremely soft and pliable vegetable fibres of a reddish brown shade, particularly the silky down from the young shoots and flowers of various plants which are woven together in such a manner as to represent felt. It is small, pendant, and purse-shaped and slung along a twig or bough which forms the roof of the structure; and not suspended from a point like the Purple Sun-Bird's or Tickell's Flower-Pecker's. The aperture is somewhat elongated and about an inch in length, with its major axis on the same plane as the twig and immediately below it. Measured from top to bottom the nest would be about  $3\frac{1}{2}$  inches, and the egg-compartment about 2 inches across. The side walls are hardly a eighth of an inch in thickness, but the baggy lower portion thickens perceptibly to about half an inch. The curious felt-like fabric and reddish brown colour are, however, unmistakeable.

Quite a number of nests are built amongst the leaf nests of a particularly vicious species of red ant in which circumstances they seem to escape molestation altogether. Not only does the colour of the decaying leaves bend perfectly



with that of the nest, but the ants when disturbed become so aggressive as to cause the intending robber to beat an ignominious retreat.

Normally two eggs are laid, but three is of quite common occurrence. In shape and size they vary a good deal, but typically are rather elongated ovals. The ground-colour varies from a light pink to a distinct rosy red usually thickly spotted and speckled with brownish pink and claret-colour, particularly towards the large end where they have a tendency to form an irregular zone or cap. A normal egg would measure about 0·6 by 0·4 inch.

*(To be continued).*

## NOTES ON INDIAN BUTTERFLIES.

BY

LT.-COL. W. H. EVANS, D.S.O., R.E., F.Z.S., F.E.S.

(Continued from Vol. XXVIII, p. 40.)

40. The following additions and corrections are needed to the papers appearing in the Journal on "Butterfly collecting in India" and the "Identification of Indian Butterflies."

- (a) Vol. XXVIII, p. 502 and 747. *Morphids*=*Amathusiidæ* as far as India is concerned. True *Morphids* are S. American.
- (b) Vol. XXIX, p. 231. Under A.I. *Troides* alter 1a to 1b in the 1st and 7th lines: alter 1b to 1a in the 1st and last lines: put 1a, *et seq.* before 1b, *et seq.*
- (c) Vol. XXIX, p. 242. Plate VI, bottom left hand figure, alter A. 12.1 to A. 11.1.
- (d) Vol. XXIX, p. 250: B. 6.1. In the B.M. there are 2 ♂ 1 ♀ of *Delias singhapura*, Wall, from Tavoy. It differs from *agoranis* in having black veins on the hindwing below. Whether *agostina*, *agoranis* and *singhapura* are conspecific is uncertain, but I prefer to regard them as such for the present, though the first two have been caught flying together by Mr. G. R. E. Cooper. The races under B. 6.1 should stand thus:
  - α. *singhapura agostina*, M. Sikkim-Dawnas.
  - β. *singhapura agoranis*, Grs. Dawnas.
  - γ. *singhapura singhapura*, Wall. Dawnas—S. Burma.
- (e) Vol. XXIX, p. 253. Mr. H. T. G. Watkins investigated the *albina-paulina*—*libythea* group of *Appias* on my behalf in the B.M. last summer. It was found that *zelmira* had been described from the Coromandel Coast and its place must be taken by *olferna*, Swin.: *swinhoei*, M. and *ares*, Swin. (not in my list) also=*libythea*. It may be remarked that, though the extreme dry season male of *libythea* superficially resembles *albina*, it may always be separated easily since there is only one tuft of hairs near the end of the abdomen, instead of two. *venusta* proves to be a *paulina* form and *flava* must be employed for the Ceylon race of *albina*. In Ceylon there are three female forms of *albina*, viz., *flava* yellow above and below: *semiflava* white above, yellow below: the common form, white above and below, for which I propose the name *norma*, nov: *semiflava* is Fruhstorfer's name, not Rober's. *melania* is a distinct Australian species and *paulina* should be substituted as the species name. *paulina* was described from the Coromandel Coast, Java and Tranquebar, while the figure accompanying the description represents a female, which might well appertain to the Javan or Ceylon form, but not to the S. Indian: therefore typical *paulina* should be regarded as Javan and *galene*, Fd., employed for the Ceylon race. The names should stand thus:
  - B. 10.4. *libythea libythea*, F. Ceylon, India.
  - libythea olferna*, Swin. Bengal-Assam-Burma.
  - B. 10.6. *albina flava*, Röh. Ceylon.
    - ♀ v. *semiflava*, Fruh.
    - ♀ v. *norma*, Evans.
    - albina darada*, Fd. S. India. Sikkim-Burma.
    - ♀ v. *semiflava*, Fruh.



- B. 10.7. *paulina galene*, Fd. Ceylon.  
           ♀ v. *lankapura*, M.  
           *paulina wardii*, M. S. India.  
           *paulina adamsoni*, M. Burma.  
           *paulina galathea*, Fd. Andamans, Nicobars.
- (f) Vol. XXIX, p. 254. The Indian Empire forms of *pyranthe* and *florella* are ;  
           B. 11.4. *pyranthe minna*, Herbst.  
           B. 11.5. *florella gnoma*, F.
- (g) Vol. XXIX, p. 255. The Burmese race of *verhueli* is not by any means the same as the Malayan *gobrias* and I propose the name *parva*, nov.  
           B. 13.1 β. *verhueli parva*, Evans.
- (h) Vol. XXIX, p. 255. Mr. H. T. G. Watkins has pointed out some errors in the genus *Gonepteryx* : the correct names are :  
           B. 14. 2. *farinosa chitralensis*, M.  
           B. 14. 3. *a. aspasia zaneka*, M.

          β. *aspasia zanekoides*, De N.

41. The following butterflies were obtained by Major F. M. Bailey in August 1916 on the Safed Koh beyond Parachinar and in nearly every case the record extends the previously known range of the butterfly :—

*Parnassius delphioides kafir*, Avin. At 13,500 feet.  
*Pieris callidice kalora*, M.  
*Pieris canidia*, Sparr.  
*Aporia leucodice balucha*, M.  
*Pararge schakra*, Koll.  
*Maniola pulchra*, Fd.  
*Karanasa hubneri*, Fd.  
*Aulocera padma*, Koll.  
*Aulocera swaha kurrum*, Evans.  
*Vanessa urticae rizana*, M.  
*Vanessa cashmirensis*, Koll.  
*Argynnis kamala*, M.  
*Argynnis adippe jainadeva*, M.  
*Argynnis lathonia issæa*, Db.  
*Zizera maha*, Koll.  
*Polymmatos eros drunela*, Swin.  
*Heodes phlaeas stygianus*, But.  
*Thecla syla*, Kollar.  
*Hesperia alpina*, Ersch.

42. The following are new butterflies from Thibet :—

- (a) *Erebia phyllis irma*, nov. ♂ above very dark brown : upf. with the usual area of modified scales on the disc and a large pre-apical black ocellus containing 2 prominent white pupils. ♀ paler brown, the area between the end of the cell and the ocellus tawny, continued under and outside the ocellus. Unf. tawny with ashy borders, ocellus as above, but with pale ashy ring. Unh. mottled brown and white, a very obscure discal and a submarginal irregular black line, between which is a row of obscure small white spots. Expanse 49 mm. Differs from all other forms of *phyllis*, Leech, in the ♂ having no fulvous colour above and in the ♀ having no yellow ring to the ocellus. S. E. Thibet, between Bhutan and Gyantse, 13,000 feet, August 1922 ; 2 ♂, 3 ♀ caught by Major F. M. Bailey : types in B. M.
- (b) *Colias cocandica irma*, nov. This name is proposed for the *Colias* figured by me on the plate opposite page 540, vol. XIII, as

*cocandica*. It differs four *cocandica*, *Ersch*, chiefly in size, 54 mm. against 42 mm. The type is in the B. M.

- (c) *Colias pugo*, *nov.* Above ♂ pale yellowish white, ♀ white, veins black dusted, costa forewing red, cilia white. Upf. base black dusted, a black spot end cell: marginal black border broad, one-third of wing, with a central row of large white spots, each of which is joined to the termen by a white line. Uph. basal  $\frac{3}{4}$  black, a white spot end cell: border broadly white, divided by black dusted veins. Below costa F and H red. Unf. white, a black ring end cell, apex yellowish green, obscure discal black spots. Unh. greenish yellow, basal  $\frac{3}{4}$  black dusted, white spot end cell; margin broadly pale, with dark dusting on either side of the veins. Antennæ and legs red. Expanse 48-50 mm. Much paler than any known form of *cocandica*, *Ersch*, and with larger marginal spots. Smaller than *irma*, *Evans*, which has red cilia: not nearly as dark as *nebulosa*, *Ob.*: differs from *thibetana*, *Riley*, in having the costa red. Nearest of all to *thrasibulus*, *Fruh*, as regards markings, but that species is yellow above. This species was recorded by Mr. R. South in B. N. H. S. Journal, vol. XXII, p. 153, as *Colias nastes*, *Bdv.*, having been obtained by Major F. M. Bailey at Pugo, S. E. Thibet, 14,000 on June 27th, 1911: 3 ♂ 1 ♀ were obtained and the types are in the B. M.
- (d) *Colias montium longto*, *nov.* ♀ above yellowish white, mostly dusted over with black scales. Antennæ, legs, costas and cilia red. Upf. veins prominently black, pale centred black spot end cell: margin broadly black, bearing large pale spots in 1, 2, 4 and 5. Uph. entirely black dusted, a large white spot end cell: large ill defined, black dusted, submarginal pale spots. Unf. white, dusted black scales, complete series discal black spots: white centred spot end cell, apex yellowish green, black dusted. Unh. entirely yellowish green, dusted black scales, red ringed white spot end cell, with an external red tongue and a red streak between base wing and base cell: obscure discal black spots. Expanse 48 mm. Resembles *montium*, *Ob.*, which occurs in S. E. Thibet, but *longto* is paler with more black dusting, resembling somewhat *cocandica*, *Ersch*. 1 ♀, the type in B. M. obtained by Major F. M. Bailey on August 8th, 1922, in Thibet between Bhutan and Gyantse.
- (e) *Lycaena orion tytleri*, *nov.* Above rather as typical *orion*, *Pall*, but much darker, smaller and wings more pointed: no traces of the usual pale submarginal markings. Below marked as in *orion*, the ground colour duller and the orange submarginal markings in consequence much less prominent. Expanse 28-30 mm. obtained by Major-General H. C. Tytler's collector at Gyantse in May 1911. Type ♂ and ♀ in B. M.
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## A JOURNEY TO SIAM AND BACK.

BY

MAJOR C. H. STOCKLEY, D.S.O.

PART IV.

(With 2 plates.)

(Continued from page 722 of this Volume.)

I left Hkambengpet on March 26th and did an uninteresting ten mile march to Nam Me Kam, a little N. of W. Very hot and mostly through dry deciduous jungle. The march was only marked by my attempts to secure a Green Imperial Pigeon, which flew from tree to tree; invariably flying out of the wrong side and also selecting the tallest trees on which to settle.

Next day we did a long hot march into the foothills to a hamlet called Ban Samui, 16 miles winding through dry jungle and undulating country covered with teak and grass. Here I halted a day and did a round through the hills to the north, to look for game. It was evidently good game country, but much of it was being burnt or had just been burnt and the game had left it temporarily. Recent tracks of bison and tsine were plentiful, we jumped a small herd of sambhar in one place and found fresh tracks of a bear in another. Jungle fowl swarmed and I found a nest containing two fresh eggs, in a curious situation. It was in a hole in the bank of a stream, the hole being about the size and shape of a Rugby foot ball, smooth inside, and with the entrance near the top. Coming back I saw an emerald dove, the first of the trip, also many other interesting birds, broadbills in particular.

We were camped in dense evergreen forest and most of the ponies strayed in search of grazing, so that we were very late in starting and had a hot waterless 12 mile march across the low hills southwards to Pong Nam Tan on the Klong Suan Mak, here a clear rippling stream with a wide sandy bed. It was here I took several specimens of *Anadebis diademoides* which to my inexperienced eye looked extremely like a *Euploea* of sorts. Another butterfly, *Danaïs mulciber*, provided me with a curious spectacle. While pitching camp I saw a sort of wavy movement in a clearing about 100 yards away and went over to investigate. The clearing was about 50 yards wide and covered with the dead stalks of some sorrel-like plant about two feet high. On these were clustered the most amazing masses of butterflies I have ever seen. They were all of one species, *D. mulciber*, and covered the entire clearing in clotted swarms. Very few were flying; they were mostly settled wherever they could find room on the dry stalks, sometimes clinging to each other.

That night the plaintive mewings of flying squirrels seemed to be in every other tree, and I set forth with the gun to try and secure one but failed.

Next morning, April 1st, we marched early and reached the Karen village of Klong Pung To at 4½ miles. The village was, as usual, built on piles, and round the shady parts of the piles and under the floors were clustered large numbers of butterflies, *Euploea godarti* and *Euploea diocletianus*. Leaving the village we entered very fine forest, and it was here I saw the largest flocks of the Great Black and Yellow-Hornbill I have ever seen. One contained 19 birds and the second 23. Their wings made a loud rushing sound as they flew: hard to describe but quite distinctive.

We camped at Klong Pong Kapo, on a narrow shelf of the bank of a small stream. It was a great place for butterflies but also for bees, and after a while I was driven inside the tent. Mahomed Kasim amused himself with the net and shortly brought to me a fine specimen of *Papilio paradoxus telearchus* the only one taken on the trip. He brought it to me held firmly by one wing, and now has the privilege of having his thumb impression on exhibition in the Natural History Museum at S. Kensington. Fortunately it was otherwise quite undamaged.





HEAD OF BISON SHOT IN ME'WANG.



OPEN JUNGLE IN THE MAN WANG VALLEY.





THE TRACK DOWN THE MELAMOUNG.



FORDING THE MEKLONG.



I went up the stream in the evening with the net, having sent Maung U with the gun to shoot squirrels, and, not 40 yards from the tent, put up a handsome Malay Tiger Bittern. Further on I saw a couple of little tamioys which I wanted, and felt rather sore about things, until a little later Maung U returned with a very fine Flying Squirrel (*Petaurista annamensis*) and two Jungle-fowl, one of which I gave him. He also ate the bodies of the specimens after skinning. All the camp here ate freely of a white flower, rather like a large and very fleshy spiraea, which they said was excellent when cooked. I tried it, but found it had an unpleasant musty flavour.

Next morning I climbed the hill behind camp to look for game, and at the top of a ridge about 800 feet above camp came on a sounder of pig 15 strong. I wasted so much time looking for a boar that they got my wind and bolted, a snapshot failing to kill. There was no boar in the lot but they were all of the lean black heavily crested type which I had seen near Lampha. I saw a couple of barking deer in the course of the morning but failed to get either.

On the 3rd we marched about 10 miles mostly through an evergreen jungle. At 3½ miles we reached the Klong Sai, where I shot a Lesser Thick-billed Green Pigeon and a Great Hornbill. The latter's breast provided a couple of excellent fillets later on. Forging the Klong Sai we entered the densest bit of evergreen forest of the trip. It was about 5½ miles to camp, and for a great part of it one could not see a man five yards behind one on the track. I shot a Green-legged Hill Partridge at one place by kneeling down and peering through the stems, but it took us ten minutes and hard work with a dah to recover it. In places where the path opened to a yard wide, I took several lovely *Arhopalas*, mostly *atosia* and *alea*. They flit across from one evergreen to another with a flash of Antwerp blue in a patch of sunlight and seem to vanish until one detects a sober brown insect settled on a leaf with closed wings. Near camp I took several specimens of *Lebadea martha*, also one of *Laringa glaucescens*, the only one seen. E Ka Klo was a bad camp, very cramped in a narrow valley with dense jungle. In the evening a mouse-deer was added to the bag. Here occurred our first serious misfortune. That evening four ponies were missing. I had a grazing guard out of two men, but they came in at sunset to fetch halters, saying the ponies were alright and about 200 yards upstream from camp. Half an hour later they came in with 10 ponies saying four could not be found. At 2 A.M. two ponies trotted into camp and next morning I found by their tracks that they had been right over the next ridge. We searched all next morning but the jungle was desperately thick and I fancy the missing two were quietly removed by tigers whose stronghold we were just entering.

We reached Klong Klung next evening, passing the Man Wang stream at three miles, and ten miles in all to a bad camp by an old grass grown village site in the river bed. Here the Siamese guide brought me a fruit with a hard woody outside, the size of a large lemon, and recommended me to try the inside. I found a little mawkish pulp and some seeds inside, neither of which were to my taste. The Siamese asserted that the Great Hornbill eats this fruit I asked him how they opened them, and he said they eat them whole, which I doubted until he was backed up by all the others. Later I shot a Hornbill with one in his crop, but how he swallowed it or how his digestion tackles the thick woody shell I do not understand.

I halted next day to send for some rice from a village about 5 miles down stream and myself had a try round for game, jumping some sambhar and a barking deer. It is very hard to walk noiselessly in thick dry jungle, but the Karen with me insisted on putting aside every stick and bamboo to allow My High Mightiness to pass; usually breaking off the branch with a loud report or standing on a bunch of dry bamboos with a very good imitation of a Gatling Gun. This did not make hunting any more easy.



On April 6th we began to get into real game country. We marched westwards up the Klong Klung for 4 miles, then turned S. up a subsidiary stream called the Hue Tah So about  $11\frac{1}{2}$  miles in all. About two miles before camp I saw fresh tsine tracks, and thought of stopping to take a rifle off a pony, but decided not to as it meant off-loading, and it was an improbable chance after all. I had a gun and lethal bullets with me. A mile on we topped a ridge and came to a slope of fresh green grass, and there, 100 yards away down the slope was a herd of tsine, 5 or 6 cows and two bulls. One of the latter was a young one of the usual rufous colouring, but the other was nearing his prime and had a very curious coat, grey down to the middle lateral line, then red below. I have seen many tsine bulls but never one like that. I ran down behind the cover of a fallen tree, pushing a couple of lethal bullet cartridges into the gun, and got within about 20 yards, took careful aim at the bigger bull and pressed the trigger. Result two miss-fires. The herd now must have got my wind, for they made off to my right, disappearing in some bushes, but came on top of my ponies and turned off. The bigger bull, however, came straight back towards me. I had changed the cartridges and tried again when he was within 20 yards, result two more miss-fires. He had been coming straight at me where I stood partially under cover of a fallen branch. He must then have caught sight of my topi, stopped dead just as I pressed the trigger for the second attempt, turned round and made off. Up to then I certainly thought he was charging me, which shows how careful one must be in making such assumptions. I discovered the cause of the miss-fires later. There had been a heavy shower of rain the day I went out from Ban Samui, and Gunjanaw had been carrying my water proof haversac with the flap pushed inside, so that all the rain had entered and formed a pool at the bottom. The four lethal cartridges had been in this, and I had told Gunjanaw to throw them away and take four more from the gun case; instead he had dried them and replaced them. A mile through open grass and tree jungle and we turned off the track and descended to a stream to camp. Near the bottom out burst a bull bison and was gone in the jungle on the opposite bank just giving me a glimpse of a fine pair of horns.

Arrived at the bottom, I found a nice shady flat beside a gravelly stream, and we started to camp. Then things began to happen to Nawash Ali. He put down his hurricane batti on the ground by the tree at the foot of which he intended making the kitchen fire. Out dashed a jungle hen from the dead leaves amongst the roots, knocked over the lamp and fled with a squawk. This startled the bearer but we were five fresh eggs to the good and in an eggless country. Then Nawash Ali lit his fire and about two minutes later he and Mahomed Kasim leapt in the air with a yell and fled in different directions. On enquiring I found they had been stung by a "shaitan." Approaching carefully I discovered a wasp's nest on the tree trunk about 10 feet above the still smouldering fire. It was just like overlapping scales and was inhabited by a small dark brown wasp with no yellow markings. Later on we removed the kit to a site further down, but in the process Mahomed Kasim got stung again, this time on the nose, and I got stung on the hand. I can testify to the virulence of my sting, while Mahomed Kasim's nose gave visible, and much enlarged, evidence. I am glad to say we were not the only sufferers. Maung U, having nearly split himself laughing at the victims, went to fetch the hurricane batti when he thought all was safe. He bent over to pick it up, and—afterwards went to sit in the nice cool stream for a bit.

I had a look round for a tsine in the afternoon, but although I saw plenty of tracks, both old and fairly recent, none of the makers were to be found. That night we heard elephant to the W.

On the 7th we started early, and after a short climb of 250 feet, crossed the dividing ridge into the Mewong watershed, the valley we entered trending S.E. about  $1\frac{1}{2}$  miles gradual descent through open tree and grass jungle, where tupai's

abounded, brought us to a dry sandy nullah full of brushwood, where there were fairly recent tracks of bison, and where we lost the path in the undergrowth. It took the best part of an hour to pick it up again, and then we climbed about 600 feet to the west of the next ridge, and dropped down 300 to a small spring at the head of a very pretty open gravelly valley, all scattered trees and long grass. Here I disgraced myself by letting sentiment get the better of science. A couple of large langurs appeared in front of me, and jumped into a small tree about 30 yards away and sat looking at me. They were light, almost white grey with long fine hair, and appeared much bulkier than our familiar *Presbytes entellus*. Also their hands and feet were not black. I felt I ought to slay one in the interests of science, but I loathe killing monkeys, and these two were so particularly confiding that I could not bring myself to do it. I fancy they must have been *Presbytes robinsoni*. The track now kept up almost level on high ground W. of the nullah bed, and steadily for four or five miles along it were the fresh tracks of a tiger who had proceeded us only by an hour or less. At about 8 miles the track took us across a series of low jungle covered ridges until we found ourselves descending into what was evidently the main valley of the Mewong stream. Here we lost the track altogether, and after two miles of struggling through bamboo jungle, we came to a dense belt of jungle clothing the river bank, through which we had the greatest difficulty in finding a way for the ponies. Eventually we emerged into the river-bed, here sandy and about 80 yards wide, and after paddling up stream for half a mile through a couple of inches of clear running water, I found a suitable camping ground on the right bank.

While pitching camp a tiger roared in the forest on the opposite bank, and this sound I was to hear every few hours for the next week. Tigers are very numerous in the Mewong, and unusually noisy.

Since leaving Hkambengpet we had marched almost due south, except for the first two days; we now turned west up the Mewong, and I pushed up the left bank on the 8th looking for a suitable camp.

The track was decidedly rough, the first two miles across a fairly open depression, then up among the ridges high above the stream. At seven miles we descended to the flats by the river, which now flowed amongst rocks and grass-covered sandbanks, and made our way through a stretch of most abominable bamboo-thorn. I was about 200 yards ahead of the ponies when there was a tremendous rush and crashing of bamboos on my left by the river, and I ran through the tangle as fast as I could, arriving with a scratched face and a mere remnant of a shirt, just in time to see the tail end of a buffalo disappear into the jungle on the far bank. It was impossible to take up the chase then as I had to see the camp pitched, and I had not yet found a site. Returning to the track I put up a sambhar and two barking deer in the next half mile, and then the track led us across the river and I found a good site for camp on a bamboo flat on the right bank. Here I shot a Black-necked Stork for the breast fillets, which are quite good eating.

Camp was on the east side of a long narrow loop the river makes in flowing round a low jungle-covered ridge. This loop was about  $\frac{3}{4}$  of a mile in depth, but across the neck of the ridge was only about 350 yards, and in the evening I crossed it to explore the valley to the north. On reaching the river again on the far side of the ridge I found a boggy patch covered with tracks of bison, tsine, buffalo and tiger. Some of these last were fresh, but all the others were from two to four weeks old with one exception, that of a solitary bull buffalo, evi-

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*Note.*—I have been in the Mewong again this year in February, and saw five tigers (shooting two of them) and the tracks of many more but never heard one roar, and only once "the titting" call. Is this seasonal? Comment invited. -C.H.S.



dently my friend of the morning. About five hundred yards higher up, the valley widened and there was a stretch of reeds and marsh about a couple of acres in extent, and I tracked the bull into this. Not being fool enough to take on a buffalo in high reeds and sticky mud, I lay down under cover on a high portion of the right bank and waited until after sunset in the hope that he would emerge for his evening feed, but nothing showed, though a tiger roared in the jungle behind me. On the way home I jumped another tiger as we came down the slope of the ridge which faced camp, and he had evidently been watching the ponies grazing in the river-bed. I got rather a shock when he bolted from behind a bush twenty yards away, but this was only the prelude to an unpleasantly lively night.

I had dinner shortly after dark and had just finished when I heard some large animal snorting on the far bank of the river. There was a fire burning at each end of the camp, but the beast entered the river-bed and came towards camp "click, clack" over the loose stones and, after splashing through a couple of pools, halted, snorting and breathing heavily, about thirty yards from me. By this time I had my rifle and was entrenched behind an absurdly inadequate tree, peering at the black mass through the darkness, and uncertain what to do. The whole camp was in awed silence, broken only by Nawash Ali, who remarked in a strained whisper when the brute shifted its feet, "It's going to charge now." This lasted two or three minutes, and I was greatly relieved when our visitor turned with a contemptuous final snort and walked back whence he had come.

I had naturally assumed from his truculent attitude that I had had a buffalo to deal with, and had visualised the nasty results if he charged the camp in the dark, but I was greatly surprised, on inspecting the tracks with a lantern, that it had been a bison bull which had behaved in this eccentric and trying manner. I traced him for two or three miles in the morning, and he seemed to be making steadily for the Klong Klung by the track which we had followed. This incident over, I went to bed and had just put my head on the pillow when there was a nerve-racking "aungr-r-r-r-h" from a tiger about thirty yards from my bed, quickly followed by a repetition of the noise from the men's end of the camp: two of the brutes undoubtedly, and more trouble. Yells and cries from the men, and snorts and violent halter-straining by the ponies which the enemy were evidently trying to stampede into the river-bed. I shouted to the men to get to the ponies' heads, and was still hunting for a stray shoe when the sounds were repeated and two ponies broke away. This was too serious, as the previous loss of two at E Ka Klo had cut my transport and rations very fine, so I made a wild dash and fortunately managed to grab both ponies just as they reached the foot of the bank, and hung on until the orderlies and one ponyman reached me. None of the others would move from the fire.

After hobbling all the ponies with loading ropes and lighting two more fires I went back to bed, and though we were twice again disturbed during the night nothing untoward happened, our enemies giving a final and combined roar while I was dressing at dawn.

Tigers were undoubtedly very numerous and unusually vociferous in the Mewong, and although it is a common trick with lions I have not before heard of tigers trying this stampeding game on a camp. The Karens all said that the tigers there were only dangerous to men who travelled alone, and that they never attacked two or more together. I gave orders that no one was to leave camp for woodcutting or other purposes unaccompanied, and were not to go more than a couple of hundred yards.

I had decided to try downstream that morning, but found that the lower I went the scarcer the game seemed to become, though about three miles down I heard a sound, twice repeated, which could only have been a rhino bubbling in his wallow. The Karen with me immediately said "Rhino." A search of the hill from which the sounds had come was quite unsuccessful, and I could



find no tracks. The river here flowed though hard black rocks full of deep pools, and the bed was so broken that progress was very difficult, and as the bamboo thorn on the banks was an even worse obstacle I turned back at about 10-30, shooting a buck barking deer a mile below camp and getting in about noon.

The whole camp seemed to be engaged in paddling and Maung U came up to me with a handful of eggs which I immediately took to be from an owl's nest, as they were spherical in shape, with hard glossy shells through the white of which the yolks showed faintly pink. Maung U then told me that they were from a turtle and showed me a female which they had just caught and which weighed 16 pounds. All the turtles' eggs I have seen before were dull white with chalky leathery shells. The men caught a lot of smaller turtles and also a land tortoise weighing over twenty pounds. I sent the carapace of both the big turtle and the tortoise to Dr. Malcolm Smith and he said he was not certain of the species. A little later a large tortoise was captured weighing over 20 lbs. The turtles' eggs were excellent eating, and I got over 40 of them, though I do not know whether they all belonged to the same female.

Shortly before getting back to camp I had heard the sound of a shot from up the valley, and found the guide and the Karen hunter had gone out to find the track for the next march. They came in about 1 o'clock, and I taxed them with having fired. They denied it at first, but on my pointing out that the Karen's muzzle-loading blunderbuss had been very recently discharged, they admitted that they had seen the buffalo bull on their way back, and had fired to frighten him away, as he was in the middle of the river-bed. On going out in the evening I found that they had succeeded so thoroughly that the bull had departed by the same game track as the bison bull had taken; and evidently for the same destination. This was annoying, as buffalo were evidently scarce.

About 3 o'clock I saw two of the pony-men emerge suddenly from the opposite jungle and walk rapidly to camp, where they sat down in the shade with rather a chastened mien. On enquiry I found that they had disobeyed my orders, and wandered off to have a look at the country from the neck of the opposite ridge. Here they met a tiger suddenly; evidently the same one which I had jumped the previous evening. I took the rifle and went across to look for him but failed to get a shot, though I caught a glimpse of his tail end as he made off.

Next day, the 10th, I shifted camp five miles upstream to get nearer the pass and find the onward track.

The path was very hard to follow, and in a bit of thick evergreen we were quite deceived by an elephant path. A small herd had walked along the track in file, and on into the jungle. Where they had walked was a nice beaten path, and we very naturally missed the point where they had diverged from the right track and followed their route. After about half a mile they had dispersed to feed and our nice beaten path ended suddenly in a tangle of broken bamboos, so we had to return and search for the right trail.

About three miles up the river we crossed to the right bank and I sat down on a large fallen tree to wait for the ponies. While there, a hen silver pheasant jumped on to the trunk about 15 feet from me, and I was interested to note that her breast feathers showed no V-shaped white markings as in the hen which I had shot at Pang Yao, but only small white spots. She flew away after about a minute, and I then rose and immediately put up a fine cock from almost under my feet. He was remarkable for a very long and pure white tail. The Pang Yao birds were got at about 3,000', while here we were only at about 700', and the character of the jungle was quite different; at Pang Yao it had been mainly big evergreen forest, here the trees were mostly deciduous mixed with bamboo, the forest smaller and the humidity much less.



Crossing the river we entered a tract of giant bamboo growing on a level flat with plenty of grass beneath them. This flat was covered with old tracks of two small bands of buffalo, three and five in number, and they had evidently been residing there up to about three weeks previously. I also picked up here the skull of a bull buffalo with horns about 40 inches long, which, judging by the teeth and cranial sutures, was not an old animal.

Leaving this flat we forded the river twice to cross a small loop, and climbing up the right bank, came on a nice spring about 40 yards inland, at the foot of a magnificent *Ficus* which was in fruit and crowded with green pigeon; mostly the Pin-tailed species, but also the Thick-billed and Orange-breasted. As we approached the spring three sambhar dashed away from a patch of undergrowth. Judging by the size, I think one of these was a stag, but I saw no stag with horns out of the thirty or more sambhar which I saw in the Mewong, and I think they had just shed them.

Leaving the spring we entered a beautiful glade of grass and teak trees, which was covered with old tracks of game, and re-crossing the river, camped amongst giant bamboo on the left bank.

In the evening I explored the valley above camp, and found the jungle very thick, with numbers of sambhar in it. I came on a party of half a dozen in the river-bed, and shot a hind for meat. She fell on the opposite bank and rolled down through some bushes, and I went across to examine her. Finding she was badly afflicted with that curious sambhar disease "sore neck," I caught hold of the head to pull her into a better position, and was immediately covered with red ants, a nest of which she had torn down in falling. I had to run to a pool and divest myself of shirt and shorts as quickly as possible, but did not escape without a severe biting. "Sore neck" has never been explained satisfactorily. Evans in "Big Game Shooting in Upper Burma," says that all sambhar have it; but though this may be so in the wild state it certainly is not in captivity as I have recently examined sambhar in both the Calcutta and Karachi zoos, which showed no trace of it. It begins with a circular naked patch the size of a rupee, which has a small raw spot in its centre, and which may spread so as to cause the loss of all the hair of the neck except the crest, as had happened in the case of this particular hind.

On the way home I had a very curious experience. We were about 500 yards from camp and heard a sound like the blows of an axe quite close to us. I was annoyed, as I thought that some one had disobeyed orders and gone too far to gather fuel. I traced the sound to a dead tree about 150 feet high, and walked round it with the Siamese guide trying to locate our man, who, by the sounds, seemed to be about fifty feet up the tree. We could see nothing, and were standing there puzzled, when, with a loud rending crack, the tree began to fall straight towards us, and it was only by a speedy dash to one side that we avoided being crushed beneath it. The sounds we had heard were evidently the preliminary breaking of dead fibres inside the trunk, but the effect of the incident was disturbing, and I sympathised with the Siamese who said the Mewong was full of devils.

This man had told me that he knew of a salt-lick to which the buffalo had probably gone, so I took him out next morning and went down stream to Pigeon Tree Spring, then started up the hill to the south. We laboured up a long way and the ground grew less suitable for buffalo the farther we went, so I finally demanded an explanation from the guide. He said that he thought I wanted sambhar: the fact of the matter being that he had not expected to be taken out after buffalo, and funk'd it. I started down the next ridge, seeing a dozen or more sambhar, and half way down found the fresh tracks of a bison bull. From the tracks he did not seem to be unusually big, and I wanted buffalo much more than bison, but as they led in the right direction I took them up.

They led me straight down to the giant bamboo flat where I had found the buffalo skull the previous day, and, passing through this entered a tract of bamboo thorn. Fortunately I had not far to go through this, and after about 200 yards, up rose my bull from a small knoll about 35 yards away. I could only see him indistinctly through the bamboo, and he turned and trotted off to the right, so I dashed in to cut him off, passing the guide who was squatting grey with fright, and ran into my bull at about 25 yards range, when a bullet through the heart as he swung round to meet me, settled matters.

I had been very lucky in finding a fairly clear lane through which to attack, but I found I was still more fortunate when I saw what a grand trophy I had secured. He measured  $45\frac{1}{2}$  inches across the horns as he fell, and now, after drying and shrinking, they measure  $44\frac{3}{4}$  inches across, with a girth of 20 inches and length of  $31\frac{1}{2}$ : this is as shown in Rowland Ward's "Records of Big Game" (8th edition) in which he tops the list of heads measured by them.

I sent back the guide for more men, and, after photographing the bull, skinned off his neck—skin to the head, which I then cut off, and it took four men to carry it back to camp, where it took me three hours labour and the acquisition of some grand blisters on my hands, to complete the skinning. Paring the skin took several hours a day for the next week, as the skin dried hard as flint on the inner surface in the heat and remained soft in the centre, so that even with the most careful use of preservatives I almost failed to save the mask.

*(To be continued.)*

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## INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

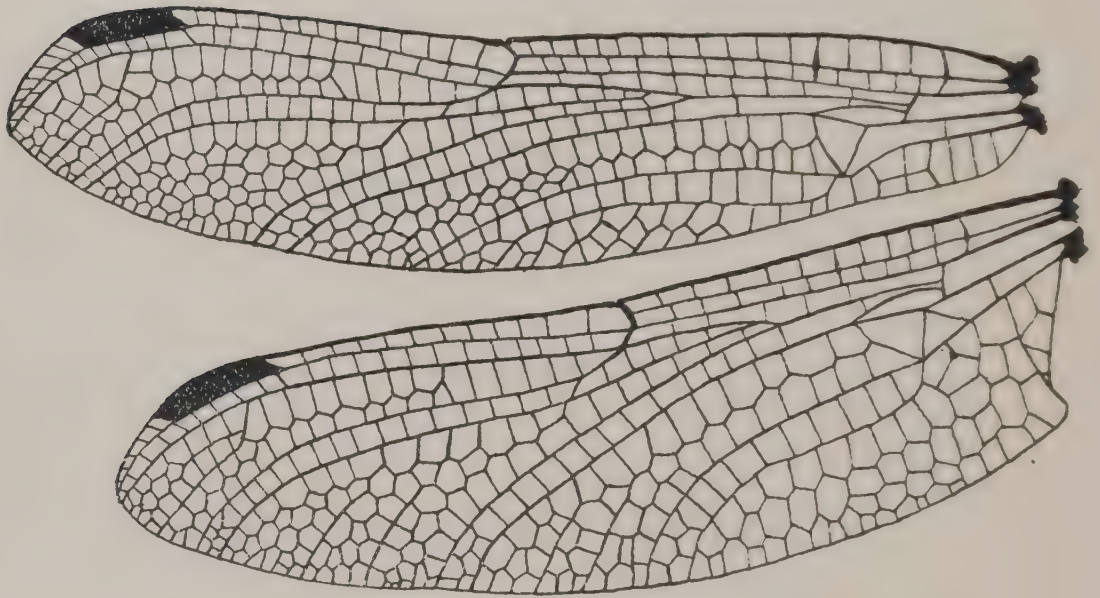
Part XVIII.

(With 2 Plates and 2 Text-figures.)

(Continued from page 680 of Vol. XXIX.)

Group—ONYCHOGOMPHUS Laid.

( = Genus—ONYCHOGOMPHUS Selys.)

Fig. 1.—Wings of *Lamellogomphus acinaces* Laid. ♂

In this group are included all the species belonging to the Selysian genus *Onychogomphus*. It has long been evident that such a heterogeneous collection of species must sooner or later be split up into a number of subgenera and so far as the Indian species are concerned, Laidlaw has already begun this dissection by splitting up the genus into four sections.

Of these, in this paper, Section II becomes genus *Mesogomphus* Forst. and Section IV genus *Lamellogomphus* gen. nov. Dr. Ris in discussing the former genus, an African one, states that it probably embraces some species from India, obviously having in mind *Onychogomphus lineatus* Selys and allied species. A careful comparison of this species with others of the genus *Mesogomphus* fails to reveal any characters of sufficient importance to separate it from the genus. As regards raising Section IV to generic rank, in addition to the striking and characteristic facies of the insects composing the group, I am relying on certain larval characters which in themselves are of sufficient importance to justify the step. Although most of the larvæ are as yet unknown, I think it quite safe to infer that they will all be found eventually to share the characters of those of *L. nilgiriensis* and *acinaces*.

Lastly as regards Sections I and III, more material, especially larval is needed before any further steps in classification can be adopted, these two sections are therefore grouped together under the original genus *Onychogomphus*.

In writing up the group I have been greatly helped by, and am much indebted to Messrs. H. Stevens, H. V. O'Donel and C. M. Inglis all of whom have generously contributed material without which much of the descriptive matter could never have been written.

#### GROUP CHARACTERS.

Fore and hind wings showing equal specialization in regard to transverse nervures between *Mi-iii* and *Miv*; sectors of arc well separated, parallel at origin and well curved; *Cui* and *Cuii* in hindwing parallel or nearly so as far as wing margin; pterostigma braced; *Miv* and *Cui* in fore wing parallel as far as level of node; *Ai* separated from *Aii* by two rows of cells from immediately below the subtrigone; 2 or 3 rows of cells between *Mi* and *Mia* at level of outer end of stigma. Legs short, hind femora only slightly overlapping the posterior end of thorax when adpressed.

Larva very variable.

Genus—**LAMELLOGOMPHUS** gen. nov.

=Genus—**ONYCHOGOMPHUS** group—**O. BIFORCEPS** Selys.)

Moderately large to large insects with a jet black ground colour and limited but sharply defined yellow or yellowish green markings.

Dorsal bands confluent or not confluent with mesothoracic collar; humeral stripe present, vestigial or entirely absent; dilatation of end segments of abdomen begins abruptly at base of segment eight, the apical half of segment seven barely dilated. Anal appendages of great length, the inferior usually overlapping the superior which, except in *acinaces* are strongly hooked downwards so that the dorsal surface of their apices comes into contact with the dorsal surface of the inferior appendage; branches of latter separated near origin, then converging again until the apposed apices enclose a small oval foramen.

Genitalia variable.

Larva with the penultimate segment of antennæ broadened into a flat triangular lamella; abdomen short, stout and strongly keeled.

*Hab.* Densely shaded rocky mountain streams. Genotype *Lamellogomphus biforceps* (Selys).

#### **Lamellogomphus biforceps** (Selys.)

*Onychogomphus biforceps* Selys, Bull. Acad. Belg. (2), xlvi, p. 420 (1878); Kirby, (*Lindenia biforceps*) Cat. Odon. p. 60 (1890); Will. Proc. U. S. Mus. XXXIII, pp. 308, 312 (1908); Laid. Rec. Ind. Mus. p. 407, Vol. XXIV (1922).

Male: Abdomen 41 mm. Hindwing 32 mm.

Head black, labium dark brown, labrum marked with a transverse yellow oval spot on each side, the base of mandibles, antclypeus and a broad stripe across the upper surface of frons bright yellow, the base of frons black, this colour extending as a short tongue into the floor of sulcus. Occiput black with a small median spot of yellow, slightly rounded, ciliated along its free margin.

Prothorax black with a lateral spot of yellow.

Thorax black marked with greenish yellow as follows:—a complete mesothoracic collar confluent with a stripe on the lower part of the middorsal carina, a dorsal oblique stripe not joined to the mesothoracic collar, and a humeral stripe. Laterally yellow marked with two broad black stripes on the sutures, the black converging and becoming confluent at the middle of the stripes. Beneath black.

Legs black, the four posterior femora with an outer yellow band.

Abdomen tumid at base, thin and cylindrical as far as segment 8, which is abruptly dilated. 9 and 10 narrowing again slightly, black marked with bright yellow as follows:—the sides of segment 1 and a triangular spot on the dorsum, two large spots including the oreillets on the sides of segment 2 and a lobed stripe



on the dorsum, segments 3 to 6 with narrow basal rings nearly divided by the black of dorsal carina, occupying about one third of the segments, in addition an oval spot at the middle of these segments, the basal half of segment 7 and a small rounded spot near the base of both sides of segment 8.

Anal appendages rather longer than segments 9 and 10 taken together.

Superior yellow changing to black at the tips, thick at base where they are rather widely separated, converging, tapering and finally meeting at the apices. Seen in profile the basal thirds nearly straight, the apical third curved strongly down and circling back so that finally their dorsal surface comes to lie in direct contact with the dorsal surface of the inferior appendage. The latter black, equal in length to or projecting slightly beyond the superiors, thickened at basal third where the two branches separate to enclose an oval space, after which they come together again, tapering and curving upwards to meet the superiors. The two sets of appendages thus enclose a large subtriangular space when viewed from the side.

Wings slightly enfumed, venation black, costa finely yellow; pterostigma deep blackish brown (3 mm.), nodal index 8-16—13-9.

Female undescribed. Martin in "Mission Pavie" states that the female is very like the male but the yellow spots on abdomen are much larger, he gives no detailed description unfortunately.

*Hab.* Darjeeling. Type in the Selysian collection; another male in the Indian Museum collection, taken in May 1913. These, so far as I am aware, are the only Indian specimens known but Martin has recorded it from Tonkin where it is apparently not uncommon.

#### ***Lamellogomphus inglisi* sp. nov.**

Male: Abdomen with appendages 41+4 mm. Hindwing 36 mm.

Head. Labium pale yellow, the border of median lobe narrowly brown, base of mandibles broadly greenish yellow, labrum glossy black with a large transversely oval greenish yellow spot on each side, anteclypeus and a large spot on each side of postclypeus against the eye citron yellow, frons black, greenish yellow above, this colour slightly overlapping the foreborder, base of frons narrowly black which projects for a short distance into the sulcus, rest of head matt black except for an obsolete spot on occiput which appears to be due to translucence of a greenish yellow spot on its posterior surface. Border of occipital scale rather sinuous, fringed with long black hairs. Eyes bottle green.

Prothorax black with a small citron yellow spot on each side.

Thorax black marked with yellow as follows:—a mesothoracic collar narrowly broken in the middle line, antehumeral oblique stripes extending from the alar sinus but not meeting the mesothoracic collar, a vestigial humeral spot above, the whole of the sides except for a very broad median black stripe which bears a small transverse oval spot of yellow immediately below the insertions of wings.

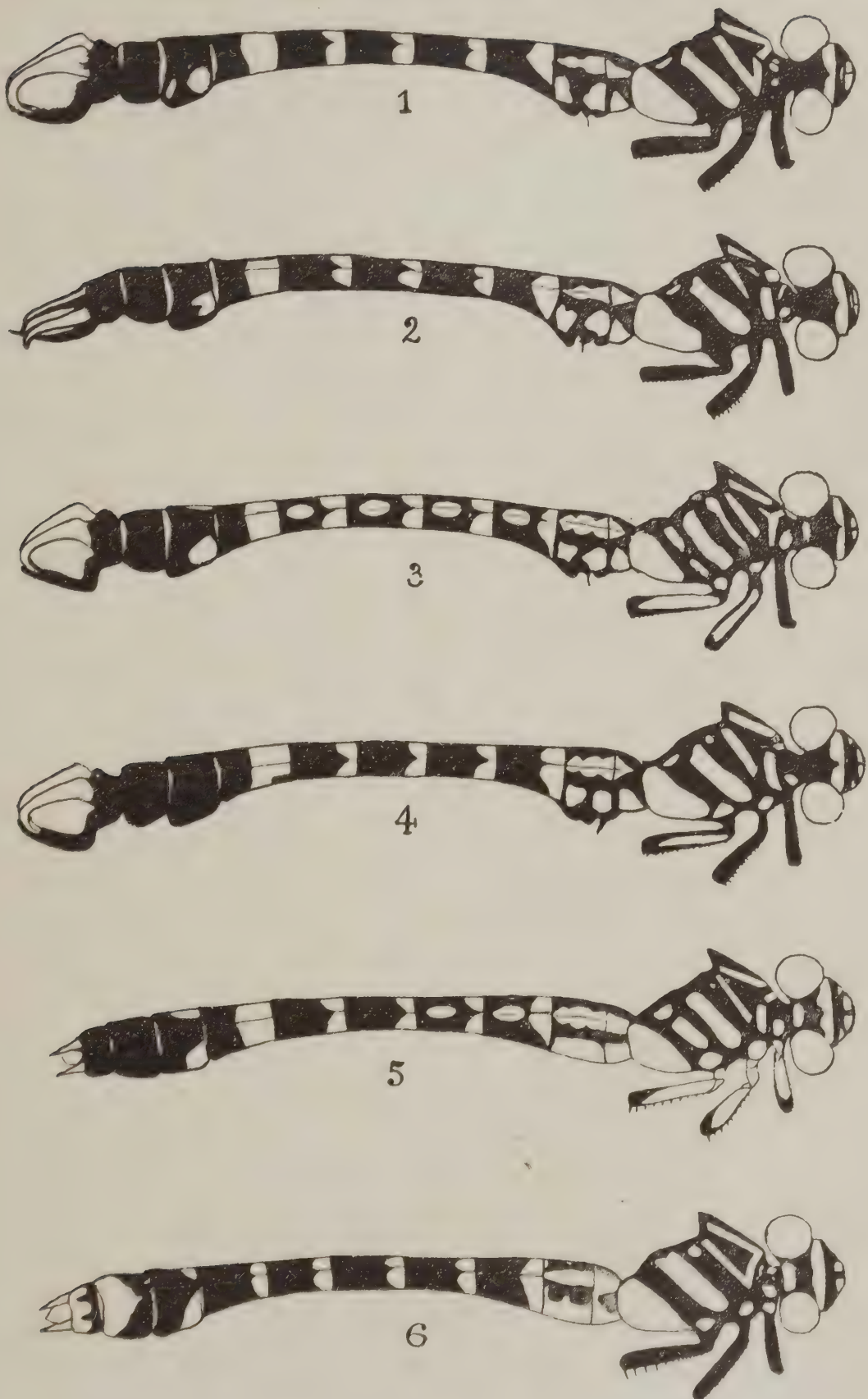
Legs black, the posterior pair of femora only bearing an outer yellow stripe. Coxæ and trochanters yellow. Hind femora furnished with a row of closely-set evenly spaced short but robust spines on the outer side; mid femora with longer, less closely-set spines.

Wings palely enfumed, costa finely yellow to well beyond the node, nodal

index  $\frac{12-17}{13-12} \mid \frac{17-12}{13-14}$  stigma well braced, black, 3 rows of cells between *Mi*

and *Mia*.

Abdomen tumid at the base as far as segment 2, very narrow and cylindrical as far as extreme apex of segment 7; 8 to 10 greatly expanded, black marked with yellow as follows:—segment 1 with a large lower lateral spot and a linear transverse apical dorsal spot, 2 broadly yellow on the sides including the robust oreillets, a linear stripe on the middorsum broadening basalwards and longitudi-



EXPLANATION OF PLATE I.

1. Dorso-lateral view of *Lamellogomphus nilgiriensis*, Male.
2. The same of *Lamellogomphus acinaces*, Male.
3. The same of *Lamellogomphus bifaceps*, Male.
4. The same of *Lamellogomphus inglisi*, Male.
5. The same of *Lamellogomphus malabarensis*, Female.
6. The same of *Lamellogomphus drummondi*, Female.





nally cleft at the base by a brown mark on the dorsal carina, segments 3 to 6 with basal annules occupying about the basal fourth of segments, all nearly cleft by an invasion of the black along the dorsal carina posteriorly, segment 7 with rather more than the basal half greenish yellow, the basal half of this marking on the sides is squarely pale brown. Segments 8 to 10 unmarked.

Anal appendages about the length of segments 8+9, the superior yellow, posterior two thirds straight as seen in profile, apical third curling strongly down and then actually back so that finally its dorsum comes into contact with the dorsal surface of the inferior appendage. The latter black, cleft to its base, curving at first down and then bent at a right angle and prolonged to overlap the superiors. A little dilated at base, then thin and cylindrical for as far as middle third where it dilates rather abruptly and tapers to the ends, its branches separated at base to enclose a long oval space. The appendages by their apposition enclose a large cordate space as seen in profile.

Genitalia—lamina broad depressed and obtusely notched, inner hamules converging long sinuous, broad at base and tapering to a fine outwardly turned point, outer hamules broad and conical, projecting well beyond the genital sac and bearing a stiff pencil of hairs at the apices, lobe broad and deep, funnel-shaped but not markedly prominent, surface black and coarsely corrugated.

Female: Abdomen 45 mm. Hindwing 38 mm.

Very similar to the male, markings similar in every respect. Wings rather more enfumed, pterostigma well braced, blackish brown, 2 or 3 rows of cells

between *Mi* and *Mia*, nodal index  $\frac{13-19}{12-14} \bigg| \frac{18-12}{13-13}$ .

Anal appendages yellow, very fine and rather longer than segment 10.

Vulvar scale very short triangular, deeply encased by expanded sides of segments 8 and 9. Legs coloured as in the male, hind femora with a row of short but robust closely-set spines on the proximal half and 3 to 6 much longer, more robust and more widely spaced spines on the distal half.

The markings in the Hasimara female, which is distinctly teneral, are distinctly broader and there is some evidence of a broken yellow stripe traversing the lateral black stripe of thorax and there are small baso-lateral spots on segments 8 and 9.

*Hab.* A single pair collected by Mr. C. M. Inglis on the Riyang River, Mangpu, Darjeeling District, 1800 ft. 17, V. 23. A female collected by Mr. H. V. O'Donel at Hasimara tea estate, Duars, Bengal.

This species differs from *L. biforceps* by the colour of the labium, the presence of lateral yellow spots on postclypeus, the vestigial character of the humeral line, the absence of middorsal markings on segments 5 and 6, the larger size and greater number of antenodal nervures. From *L. camelus* (Mart.) by the absence of excrescences on segment 8; by its smaller size, etc.; from *acinaces* by the shape of the anal appendages and from *nilgiriensis* by its much larger size and markings.

#### ***Lamellogomphus drummondi* sp. nov.**

Female: Abdomen 45 mm. Hindwing 40 mm.

Head. Labium with middle lobe entirely black, lateral lobes pale yellow, labrum black with a transversely oval yellow spot on each side, anteclypeus yellow, rest of face black. Frons greenish yellow, its base above narrowly bordered with black, the black only slightly encroaching on the floor of the sulcus, occiput largely yellow, raised into a point at its centre, behind greenish yellow. Eyes bottle green.

Prothorax black marked with a small yellow spot at centre of posterior lobe in front of which is a much larger geminate spot of the same colour, finally a large spot of yellow on each side.

Thorax black marked with yellow as follows:—a complete mesothoracic collar, oblique antehumeral stripes extending from the alar sinus above to the



mesothoracic collar below with which they blend, a minute upper spot representing a vestigial humeral band, laterally yellow marked with a broad median black band which bears a minute yellow spot above just below the insertions of wings and a very narrow line well separated from it below.

Legs black, *the anterior femora only* bearing a well defined yellow stripe on the inner side. Armature similar to that of the female of *L. inglisi*.

Abdomen black marked with yellow as follows:—segments 1 and 2 broadly yellow on the sides, a broad middorsal stripe tapering gradually from the base of segment 1 to apex of segment 2, leaving a narrow black stripe between itself and the lateral yellow, segments 3 to 7 with yellow basal annules occupying nearly the basal fourth of each segment, segment 8 unmarked, 9 with a broad dorsal yellow spot covering its apical half, 10 almost entirely yellow, marked with a small subdorsal basal triangle of black on each side.

Anal appendages short conical, bright yellow.

Vulvar scale deeply sunk between the overhanging sides of segments, short and tongue-like, about one third the length of segment 8, black.

Wings palely enfumed, pterostigma dark brown, weakly braced in three of the wings, not at all in the fourth, only 2 rows of cells between *Mi* and *Mia*, nodal

index  $\frac{12-16}{12-11} | \frac{16-12}{12-12}$ .

*Hab.* A single female collected by Captain Drummond at Loimwe, 3,000 ft., Siam Road, Southern Shan States.

The venation and general facies of this insect are so similar to *L. bforceps* and *L. inglisi*, especially to the female of the latter, from which it is only distinguishable by close inspection, that there can be no doubt but that it is a true *Lamellogomphus*, at the same time the differences in the markings are so great as to distinguish it from any other species of the genus. It is very closely related to the two species mentioned and less closely so to *L. acinaces* and *nilgiriensis* from which it differs principally by its much larger size. From *bforceps* and *inglisi* it differs by the antehumeral band being confluent with the mesothoracic collar, by the basal ring on segment 7 of the same size as those on segments 3 to 6 and by the extensive yellow markings on segments 9 and 10. From *camelus* Mart (from Tonkin), the species is distinguished by the fewer antenodal nervures and by the sides of thorax yellow marked with a single broad black stripe instead of black marked by two yellow stripes.

Martin in "Mission Pavie" mentions a third species from Mandehowrie unknown to me, and gives neither name nor references; it differs from *drummondii* by the humeral stripes being entirely absent, by segment 8 marked with a yellow spot on the sides and by segment 9 with a similar spot instead of a broad apical dorsal spot.

#### ***Lamellogomphus nilgiriensis* (Fras.)**

*Onychogomphus bforceps nilgiriensis* Fras. Rec. Ind. Mus., Vol. XXIV, pp. 425, 426 (1922.)

Male. Abdomen (with appendages) 36 mm. Hindwing 30 mm.

Head. Labium entirely black; labrum black marked with two oval transverse spots of yellow varying in size from very large to very small; bases of mandibles greenish yellow as is also the anteclypeus (but in one specimen examined, this latter was quite black); postclypeus black; frons greenish yellow, its base above rather broadly black, a prolongation of this colour invading the floor of sulcus; rest of head black (but a good number of specimens with a rounded spot of yellow behind the occiput only visible when the head is tilted forward). Eyes deep bottle green or in younger specimens bluish green.

Prothorax black, occasionally unmarked but usually bearing a small geminate spot of yellow at centre of posterior lobe and outside this an even smaller spot.

Thorax black marked with greenish yellow as follows:—the upper part of middorsal carina only occasionally, a mesothoracic collar interrupted in the middle line, oblique antehumeral stripes generally connected to the mesothoracic collar but in a small percentage more or less widely separated therefrom (in such cases, the lower end of the stripe is squared off, not pointed as in *acinaces*), humeral stripe absent (only in a single male was a vestigial spot found representing the upper part of a humeral stripe), laterally two broad stripes separated by an almost equally broad black stripe, the posterior the broadest and covering the greater part of the metepimeron, the anterior slightly narrower, the black stripe nearly always with linear longitudinal spot of yellow at its upper part close to the insertions of the wings, but this occasionally absent on one or both sides.

Wings hyaline; pterostigma black, over 5-6 cells, not robustly braced; nodal index variable:  $\frac{10-15}{12-10} | \frac{16-11}{11-10}$ ,  $\frac{11-14}{12-10} | \frac{14-10}{10-12}$ ; 2-3 rows of cells between *Mi* and *Mia*.

Legs black, without markings. A row of moderately closely-set robust short spines on either side of posterior femora which converge and merge into a common field at the proximal end, hind femora with a row of more robust more widely spaced spines on either side.

Abdomen black marked with bright citron yellow as follows:—segment 1 with a triangular spot on the dorsum, its base apicalward and a large apico-lateral spot, segment 2 with a dorsal longitudinal stripe broadening at the middle, tapering at the apex, the oreillets and an apicolateral spot varying in size, segment 3 with a large baso-dorsal spot deeply cleft behind by an invasion of the black on dorsal carina, segments 4 to 6 with two dorsal triangular spots situated close to base, 7 with nearly the basal half yellow, 8 with a basal spot low down on the sides, this sometimes very minute or even absent altogether (but rarely), when very large, then accompanied by a smaller apico-lateral spot, segments 9 and 10 unmarked. (In one specimen the dorsal spots on segments 4 to 6 were almost obsolete and that on 7 was cut into two by the black of dorsal carina.)

Anal appendages black, the outer and upper surfaces of the superiors bright citron yellow to nearly as far as the apex (in one specimen examined, the yellow was restricted to a short linear streak on the basal half of the outer side only). In shape exactly similar to those of *L. biforceps* and *inglisi*.

Genitalia scarcely differing from that of *inglisi*, the outer hamules however are much longer and tapering, projecting very prominently from the genital sac.

Female: Abdomen 36 mm. Hindwing 33 mm.

Very similar to the male, the abdomen stout and cylindrical; markings differing as follows:—spots on labrum smaller, band on frons cut into two large oval spots by the black at base of frons joining up with that on front, antehumeral stripe separated from the mesothoracic collar (in the only two specimens known but this may be found to be variable when more material becomes available), the first lateral yellow stripe on sides of thorax with its upper part isolated as a separate spot, yellow markings on sides of segment 2 confluent, basal spots on segments 3 and 7 separated by the black on dorsal carina, baso-lateral spots on segment 8 very minute and apical spot never present.

Occiput armed with a pair of very long robust spines at its centre, the apices of which curl outwards.

Wings enfumed and distinctly saffronated at the base; nodal index:— $\frac{12-14}{11-10} | \frac{15-11}{10-13}$ .

Anal appendages rather longer than segment 10, tapering, black with a bright yellow tip, a long triangular protuberance between them; segments 7 to 10 progressively shortening.



Vulvar scale half the length of segment 9, cleft to its base so as to form two small triangular leaf-like processes which project back and somewhat down so as to be easily visible in profile.

Larva. Total length 23 mm. Length of hind femora 6 mm. Greatest breadth of body at about centre of abdomen 9 mm. Head moderately broad and quadrate, antennae with basal segment small and cylindrical, 3rd segment broad flattened triangular, 4th segment rudimentary, exists as a tiny spine at inner lateral angle of 3rd segment. A duplicated tubercle on the prothorax. Wing sheaths broad, extending to segment 6. Abdomen depressed, strongly keeled from segments 4 to 8 which bear robust spines on the carina, segment 7 to 10 with stout lateral spines. Mask very short, extending to base of first pair of legs, middle lobe rounded, fringed with rather long stiff brissae, mentum angulated, the whole mask nearly quadrate. The highly specialized shape of antennae gives the name to the genus.

*Habitat.* Nilgiri-Wynaad, Coorg and South Kanara, from the end of September to the third week of October. The insect which is very local, frequents shady mountain streams, generally those with clean gravelly bottoms and is found settled on rocks or twigs in mid stream. When disturbed it immediately rises perpendicularly to trees overhanging the stream. In Coorg it prefers streams almost entirely hidden and closed in by overhanging cane brakes where it may be found settled on rocks or on the gravelly beach or occasionally hawking to and fro over runlets or rapids to which places the female usually resorts to lay her eggs. Whilst ovipositing the female hovers some two feet or less over the surface of the water and drops her eggs perpendicularly into the swirling stream.

*L. nilgiriensis* is a southern species and is easily distinguished from *acinaces*, from the same districts by the shape of its anal appendages. It and *acinaces* stand somewhat apart from *biforceps*, *inglisi* and *drummondi* by their relatively smaller size, this being due to the shorter abdomen. It differs from *biforceps* by the absence of a humeral stripe and dorsal spots on the middles of segments 3 to 6, from *inglisi* by its much smaller size, by its confluent antehumeral stripes and by the absence of a vestigial humeral spot, etc., from *drummondi* by its much smaller size and by the black occiput. Its female differs from all others by the presence of two robust occipital spines.

#### **Lamellogomphus acinaces** (Laid).

*Onychogomphus acinaces* Laid. Rec. Ind. Mus. 1c. pp. 407-408 (1922).

Male: Abdomen with appendages 35 + 4 mm. Hindwing 30 mm.

Head. Labium black, yellow at the base; labrum black marked with a pair of transversely oval greenish yellow spots; anteclypeus yellow, postclypeus black; frons greenish yellow above, black in front, the base narrowly black, this colour sending a prolongation forward into sulcus which meets the black on front and cuts the greenish yellow into two oval spots; vertex and occiput black (In some specimens there is a small spot of yellow behind the occiput as in *nilgiriensis*).

Prothorax entirely black.

Thorax black marked with greenish yellow as follows:—the lower part of the dorsal carina (only in about half the specimens examined), a mesothoracic collar, complete where the mid line exists but broken when this is absent, an antehumeral oblique stripe not connected with the collar, squared above but *tapering to a point below*, no trace of a humeral band, laterally greenish yellow with a broad median black stripe, usually marked above near the insertions of the wings by a small linear spot of yellow.

Legs black, unmarked except for a broad greenish yellow stripe on the flexor surface of the anterior femora; armature similar to that found in *nilgiriensis*.

Wings hyaline, rays of yellow tinting in the subcostal and cubital spaces ; pterostigma black, over 5 to 5½ cells, braced ; usually 2 but sometimes 3 rows of cells between *Mi* and *Mia* ; nodal index :—

10-16	15-11	12-15	16-12
11-10	11-11	13-10	10-12

Abdomen black marked with greenish yellow as follows:—segment 1 with an apical triangular spot, its base resting on the apical border and continuous with a middorsal stripe on segment 2 which expands medially and tapers apically, segment 1 has also an apical lateral spot, segment 2 with two large yellow lateral spots, the proximal including the oreillet and its surrounding area, segment 3 with a large basal spot nearly cut in two by an invasion of black along the dorsal carina, 4 to 6 with smaller spots nearly or quite cut in two, 7 with its basal half yellow and 8 with only a basal spot on the sides very variable in size, usually quadrate and acutely indented on its apical border, 9 and 10 unmarked.

Anal appendages black, the superiors with the upper and outer surfaces bright yellow as far as the apices. In some specimens these appendages are entirely yellow and in such the upper surface of the inferior is of the same colour. Entirely differing in shape to those of all other species, the superiors truncate, tapering sinuously backwards and sloping slightly downwards towards the apices, equal in length to the two last segments of the abdomen, inferior slightly longer, divided into two closely parallel branches almost as far as its base, the distal halves curved gently upwards.

Genitalia almost similar to the last, the inner hamules are much stouter and more robust, the outer shorter and stouter, the pencils of hairs at their apices very long and prominent.

Female (hitherto undescribed): Abdomen 39-40 mm. Hindwing 32-35 mm. Abdomen tumid at the base, stout, parallel-sided and cylindrical as far as the anal end, black marked exactly as in the male except for the 2nd segment where the whole side is bright yellow, this in some specimens confluent with the broad middorsal stripe, segment 8 unmarked. The dorsal carina on segment 7 usually finely black so that the basal spot is cut in two.

Anal appendages yellow, very short and conical.

Occiput fringed with long black hairs, slightly notched in the middle, without the spines seen in *nilgiriensis*. Legs as for male but the hind femora furnished with a row of very long, very robust, very widely-spaced spines as in *nilgiriensis* female.

*Hab.* Coorg, North and South Kanara. Found in company with *nilgiriensis* in similar situations. Easily distinguished from all other species of the genus by its abnormally shaped appendages. The species is very closely related to *nilgiriensis* and apart from the appendages the only reliable character by which to distinguish them is the pointed lower end of the antehumeral stripe in *acinaces* and the absence of occipital spines in the female. *L. acinaces* is a far more static insect than *nilgiriensis* which as has been noted above, exhibits considerable variations ; this taken with its specialized anal appendages and with its enormous preponderance in numbers would indicate that it is a more modern and dominant insect and must eventually lead to the extinction of *nilgiriensis*.

The type which is lodged in the Indian Museum was taken by Dr. S. Kemp in North Kanara (without date, probably October 1916). This was the only specimen known until October 1923 when the species was rediscovered by myself in South Kanara, and in considerable numbers. A large number of specimens were taken on streams flowing down the Mangalore Ghat from Coorg to Kanara and eventually Mr. C. Souter, Commissioner of Coorg, found it swarming at Bhagmandala, Coorg. After having taken about 50 males I grew tired of taking more and contented myself with capturing females of which I was fortunate enough to take six out of 10 specimens seen. All were hovering over a deep pool formed by damming up the river below, and were busy ovipositing by dropping their eggs plumb into the stream." From Mr. Souter's remarks it will be seen that their mode of



oviposition is an exact parallel of that of *nilgiriensis* as observed by myself. The credit of the discovery of the female goes to Mr. Souter. The females of these two species are easily distinguished by the presence of occipital spines in *nilgiriensis* and by the antehumeral stripes in *acinaces* pointed instead of squared below.

***Lamellogomphus malabarensis* sp. nov.**

Female (Male unknown): Abdomen 42 mm. Hindwing 35 mm.

Head. Labium pale yellow; labrum yellow broadly edged with black with a prolongation of this colour from the base joining the anterior border of black; anteclypeus yellow, postclypeus black with a large spot on each side close up to the eyes; frons black traversed by a broad stripe of yellow on the crest constricted at its middle by an approximation of the black; vertex and occiput black, the latter with a yellow spot at its middle which is raised into a small tubercle.

Prothorax black with a large spot of yellow on each side.

Thorax black marked with greenish yellow as follows:—a mesothoracic collar narrowly interrupted in the middle line, antehumeral oblique stripe falling well short of the mesothoracic collar, no vestige of a humeral stripe, laterally greenish yellow traversed by a broad black stripe which is traversed by a yellow stripe interrupted above by the black stripes confluent across it.

Legs. Femora yellow mottled with black, the hind femora with a row of closely-set very short very robust black spines numbering 9 to 10.

Wings hyaline; pterostigma black, over five cells, well braced; only 1 row of cells between *Mi* and *Mia* at level of outer end of stigma; nodal index:—

10-16|17-10  
9-11|11-11

Abdomen black marked with yellow as follows:—segment 1 with a dorsal spot and its sides broadly, 2 with a dorsal stripe, bilobed and extending from base to apex and its sides very broadly, 3 with a broad basal ring and a spot situated on the middle of the middorsal carina, 4 to 6 with subdorsal basal spots confluent across the middorsal carina and a middorsal spot as on segment 3 but progressively smaller from 4 to 6, on the latter of which it is almost obsolete, 7 has the basal half yellow, 8 a large baso-lateral spot, whilst 9 and 10 are unmarked.

Anal appendages yellow, small and pointed, the intermediate process also yellow.

Vulvar scale small, deeply cleft to its base into two small triangular leaf like processes, a shallow depression on segment 9 beneath the vulvar scale very similar to that seen in *M. lineatus*.

The general conformation, size and colouring (deep black with sharply defined yellow markings) of this insect are so similar to the known females of genus *Lamellogomphus* that I have no hesitation in placing it in this genus, whilst it differs so much from all other females in its markings that it must be given specific rank.

From *nilgiriensis* it is distinguished by the yellow occiput without spines and by the middorsal spots on segments 3 to 6, the latter character also serves to separate it from *acinaces* and *inglisi*, an additional point of difference being the yellow stripe traversing the medio-lateral black stripe of thorax. From *biforceps* the entire absence of the humeral stripe will at once distinguish it, lastly it differs from *drummondi* by the presence of middorsal yellow spots on segments 3 to 6, by the presence of a lateral spot on segment 8 (unmarked in *drummondi*), and by segments 9 and 10 without yellow markings.

Described from a single specimen in my own collection taken in Palghat by Mr. T. N. Hearsey, 16 VI. 21. I had taken this for the female of *biforceps* (*Rec. Ind. Mus. Vol. XXIV, p. 124*) being deceived by the middorsal spots on segments 3 to 6 which are only found in this species and in *biforceps*, I had however overlooked the fact that the humeral stripe is well developed in the latter species.

The species will probably be found inhabiting the Annaimallai or Cardamom Hills.

Genus—**MESOGOMPHUS** Forster.

(=Genus—**ONYCHOGOMPHUS** groups—**O. COGNATUS**  
and **O. GRAMMICUS** Selys.)

**Mesogomphus** Forster, "*Die Libelluliden Gattungen von Afrika und Madagascar*" (71 und 72 Jahresber., Mannheim. Ver f. Naturk). p. 71 (1906).

Moderately large or small insects with ground colouring sandy yellow, more or less poorly marked with pale brown, dark brown or black.

Pterostigma moderately long, shorter than one fourth the distance between the node and distal end of stigma; discoidal field in front-wing narrow, only beginning to dilate at or after the level of node; no anal loop nor vestige of such in the hindwing; legs short, hind femora not extending to hinder end of thorax; abdominal segments 8 and 9 laterally foliate; 3rd to 7th very slender and cylindrical; superior anal appendages of male much longer than the 10th segment, approximate in the mid-dorsum and contiguous for the greater part of their length, inferior appendage considerably shorter, deeply divided into two contiguous branches. Vulvar scale of female broad and short, notched; on ventral plate of 9th segment a shallow depression corresponding to the vulvar scale and bordered by a low ridge.

Larva rather long, narrow and cylindrical, antennae of the usual Gomphine shape.

Genotype *Mesogomphus cognatus* (Ramb.).

Dr. Ris points out that the name as given by Förster is synonymous with that of Handlirsch's fossil genus *Mesogomphus* but as both publications date from the same month and cannot be fixed to a day, he has thought it advisable to adopt it for the living group, a procedure which is followed here.

In the key given for the Gomphinae in Part XVI of this Monograph, *Mesogomphus lineatus* appears under the old name of *Onychogomphus lineatus* and species *Mesogomphus lindgreni* and *risi* were not included as they had not been recorded at the time the M.S. was written.

**Mesogomphus lineatus** (Selys).

*Onychogomphus lineatus* Selys, Rev. Odon, p. 386 (1850); id. Bull. Acad. Belg. XXI, (2), p. 36 (1854); id. Mon. Gomph. p. 48 (1851); Kirby (*Lindenia lineata*) Cat. Odon. p. 59 (1890); Will. Proc. U.S. Nat. Hist. Mus. XXXIII, pp. 309-310 (1908); Laid. Rec. Ind. Mus. pp. 403-404, Vol. XXIV (1922).

Male: Abdomen plus appendages 37 mm. Hindwing 27 mm. Dehra Dun, N. India and Bihar.

Abdomen plus appendages 32 mm. Hindwing 25 mm. Deccan and Nilgiris.

Abdomen plus appendages 36 mm. Hindwing 26 mm. Coorg.

Abdomen plus appendages 33 mm. Hindwing 24 mm. Malabar and Madras.

Head: Labium pale yellow, labrum, face and frons sandy yellow, the latter with a more or less ill-defined brownish black line across the crest; vesicle and occiput yellow, a narrow transverse streak of dark brown separating them. In some specimens there is a narrow diffuse basalline of brown on upper surface of frons and the base of labrum may be clouded with the same colour. Occiput raised into a slight point at its centre and usually bearing a line of minute spines on either side of this eminence. Coorg specimens have three or four such spines on either side, a Burmese specimen has a continuous row along its free border, Dehra Dun specimens resemble those from Coorg, a Poona



specimen has four teeth on one side and only two on the other and in no specimens have I found the spines altogether missing although Laidlaw states that in some of my Poona specimens they are entirely lacking.

Prothorax blackish brown, the posterior lobe narrowly and a large spot on either side yellow.

Thorax sandy yellow marked with dull or dark brown or even blackish brown according to age of specimens, as follows: a dorsal line bordering the mesothoracic collar closely and turning abruptly up on either side of the mid-dorsal carina, which is black in its upper part, an antehumeral oblique line beginning from the lower end of the dorsal line and running upwards and inwards to join this line in its upper part, thus enclosing a thin stripe of the ground colour, a humeral line on the humeral suture and two lateral lines close together, all three parallel, of the two latter, one crossing the spiracle and the other mapping out the postero-lateral suture.

Legs yellow marked with black, a stripe on the inner side of all femora, an outer stripe on distal half of mid femora and a rounded distal spot or stripe on outer side of hind femora; tarsi black. Two rows of robust evenly spaced, short spines on the hind femora which converge to form a common field of spines proximally; mid femora with more numerous and more closely-set spines.

Wings hyaline, costa yellow as far as pterostigma which is pale reddish brown heavily bordered with black especially on the costal border, covering 4-6 cells,

usually well braced; nodal index rather variable:  $\frac{10-15}{10-11} \mid \frac{16-9}{10-9} \mid \frac{8-15}{8-9} \mid \frac{15-7}{9-7}$   
 $\frac{8-13}{7-9} \mid \frac{14-7}{9-8}$ ; 5-6 rows of postanal cells; 2 nervures between *Mi-iii* and *Miv*;

in the forewing, only 1 in the hind; 2 rows of discoidal cells as far as node; outer border of trigone in hindwing well angulated.

Abdomen black marked with yellow or yellow marked with black, the two colours occupying a variable space according to the age of specimens. In old adults the yellow reduced to basal annules, in young the black present as apical annules. Segment 1 with the sides broadly yellow and a large dorsal apical spot of the same colour, segment 2 has a subdorsal line of black on each side enclosing a dorsal bilobed spot of yellow, the black curving down on each side thinly behind the oreillets, finally an apical black annule of variable width, segments 3 to 7 have usually broad black apical annules occupying a variable length of the segments but generally less on 7 than on the others, a lateral line of black runs from the apical annule on each side and extends just short of the base, the dorsal carina and jugal sutures finely black. In some specimens the lateral stripe shortens as traced from 3 to 7, in others the jugal suture is so broadly black that it cuts off two dorsal spots of yellow fore and aft of itself; segments 8 and 9 with wide dilatations at their sides, black on the dorsum except for a fine basal annule and an irregular spot of the same colour on the middorsum, more evident on segment 8 than 9, segment 10 sandy yellow with the basal half or two-thirds of the dorsum black. The terminal three segments show considerable variation, thus the foliate lateral processes may be broadly edged with black or almost entirely blackish brown and the dorsal surfaces may be entirely deep black save for a fine basal ring on segment 9 and an apical ring on 10, the latter sending a slight prolongation along the dorsal carina. There are many variations of this pattern but the differences appear to be purely individual, not even racial characters.

Anal appendages dull sandy yellow. Superior truncate, as long as segments 9 and 10 taken together. In profile they slope gently backwards and downwards and then rather abruptly downwards, the apices even turning finally a little forwards. Seen from above they taper evenly to the apex and are closely apposed throughout their entire length.

Inferior much shorter, only one third the length of superiors which they resemble only in colour. Cleft deeply into two closely contiguous branches which curve at first abruptly down and then as abruptly up again, the apices, finally directed straight back at a right angle to the part immediately in rear.

**Genitalia.** Very similar to that of *M. cognatus*; lamina pale yellow, very shallow, broadly notched; inner hamules long and narrow, slightly convergent, the apices ending in a short sharp and slightly turned out hook, black; outer hamules much longer and stouter, broadish at base but rapidly tapering to a point turning directly in to nearly meet at their apices, each bearing on the inner side, a short distance below the apex a short robust spine, black, yellow at the base. Lobe deeply excavate, hood-shaped, its apex strongly indented, directed almost straight back, black.

**Female:** Abdomen 31-36 mm. Hindwing 24-27 mm. (Poona and Coorg). Closely resembles the male except for shape of abdomen which is of even width throughout, much stouter and laterally compressed, no dilatations on the 8th and 9th segments.

As a rule females are much paler coloured than males and less marked with brown or black. The lateral prolongations of black extend on to the 2nd segment, segments 8 and 9 are deep black and unmarked. In some specimens however the abdominal markings are much restricted and 8, 9 and 10 are entirely yellow. Segments 3 to 6, ventral to the lateral black stripes are pure shining silvery white, a colour rarely met with in other members of the genus. Occiput bearing four spines on either side of the middle line, very evenly disposed in all specimens I have examined. (Laidlaw states that they are entirely absent in one of my Poona female specimens). Wings palely enfumed or saffronated at the base and even more faintly along the costal margin; costa and many of the nervures, especially the nodal, light yellow; nodal index:— $\frac{6-13}{6-9} | \frac{12-5}{9-6}, \frac{7-14}{8-10} | \frac{16-8}{10-8}$ .

**Hab.** Breeds both in still and running waters; in Poona and Coorg it deposits its eggs in shallows either at the edge of a sandy beach or over ripples flowing over a gravelly bottom. The males await them here, settled on the sandy foreshore where by reason of their colour they are well nigh invisible. Occasionally they rise and patrol backwards and forwards over the shallow ripples, a favourite spot to find them. In Coorg, at Hoskoti, I found quite a number of tenerals emerging in a dense reedy swamp and can only conjecture that ova had been deposited in a tiny brook with sandy bottom which flowed into the marsh. The site was quite unusual and may have been forced on the females by the extraordinary swollen state of the rivers which in 1923 overflowed their banks and flooded large areas throughout Coorg. Larvae may possibly have been swept from the rivers and left stranded in such marshy retreats. The following is a description of the larva:—Length 25mm., of abdomen 17mm., of hind femora 5mm. Cylindrical, head moderately large; antennae of four segments, clubbed, the last segment very minute. Mask very broad, almost square, the base a little constricted, its outer surface coated with short hairs, mid-lobe straight not projecting, fringed with fine bristles, lateral lobe furnished with a long moveable hook, somewhat squat, saw-shaped, its inner border with a row of blunt, molar-like teeth. Abdomen tapering gradually to the end, 10th segment short, not hollowed out above and not furnished with spines. All segments except the 9th and 10th furnished with a blunt middorsal spine. Legs very short, femora fringed with long coarse hairs.

The larva thus differs strikingly from that of *L. nilgriensis* by its narrow and cylindrical shape and by the clubbed antennae.

*M. lineatus* is a very wary and shy insect and somewhat difficult to catch. Occurs almost throughout the year but is most common from September to November. Found throughout India, I have specimens from Burma. Ceylon



Bengal, Dehra Dun, Poona, Bangalore and Khandala in the Deccan, Madras, Palghat (Malabar), Trichinopoly, Coorg and the Nilgiris.

**Mesogomphus grammicus** (Ramb.)

*Gomphus grammicus* Ramb., Ins. Névro. p. 164 (1842);

*Onychogomphus grammicus* Selys. Bull. Acad. Belg. XXI (2)

p. 35 (1854); id. Mon. Gomph. p. 45 (1857); Will. Proc.

U. S. Nat. Hist. Mus. Vol. XXXIII, p. 309 (1907); Laid.

Rec. Ind. Mus. Vol. XXIV, pp. 371 and 403 (1922).

Male. Abdomen 33-39 mm. Hindwing 29-30 mm.

Head. Eyes bottle green; labium yellowish; labrum, face and frons sandy yellow, a fine black line below frons, another between the ante- and post-clypeus and an equally fine line at base of labrum. Base of frons, vertex and occiput black, vesicle yellowish, as also back of occiput. Behind eyes bright yellow, bordered with glossy black above.

Prothorax black with the posterior lobe. 2 small points just in front of it, a narrow anterior collar and the sides yellow.

Thorax yellow marked with black as follows:—two dorsal bands converging above, widely divergent below, markedly convex towards one another, (the middorsal carina and collar below are yellow and confluent, the former tapering into the latter), a humeral stripe on each side connecting up with the dorsal bands above and below, so as to enclose an oval spot of the ground colour, a posthumeral stripe connected with the humeral at its upper part only. Laterally both sutures finely black. Tergum spotted with yellow.

Legs yellow, femora marked with black or brownish black, the extreme distal end of outer side of hind, the distal half of outer side of middle, and the whole length of outer side of front pair; tibiae narrowly yellow on extensor surface.

Wings hyaline, palely saffronated, costa yellow; pterostigma yellow between black nervures, over 5 cells, 4 mm. long, braced; 1 cubital nervure to all wings; nodal index  $\frac{9-16}{9-10} | \frac{14-9}{10-9}$ ; 3 to 4 rows of postanal cells in hindwing; no vestige of a loop; 2 rows of postanal cells in forewing; membrane almost obsolete.

Abdomen tumid at base, cylindrical and slender as far as segment 8, the latter and 9 dilated, 10 very small. Black and yellow as follows:—segment 1 yellow with a basal black spot on each side separated by the dorsal carina, 2 with a trilobed yellow dorsal band tapering apicad and lying between narrow black stripes, sides broadly yellow, 3 to 6 yellow with broad black apical rings and a median spot on the jugal suture tapering laterally, basad and apicad. On segments 4 to 6 the apical ring sends a prolongation forwards on either side which meets the jugal spot and encloses a yellow subdorsal spot, 7 to 10 ochreous or reddish yellow, basal articulations finely black.

Anal appendages yellow, superior as long as segments 9 and 10 taken together, subcylindrical, tapering apicad; where they curve downward. Apices flattened plate-like, slightly bifid. Inferior appendage shorter, broad and flat at base, curling abruptly up in its basal half; where it bifurcates into two slender contiguous truncate branches.

Female. Abdomen 37 mm. Hindwing 30 mm.

Similar to male except for sexual differences in shape. Abdomen differs slightly in colouring as follows:—the middorsal band on segment 2, the jugal spots are more restricted and not connected to apical rings on segments 4 to 6. Segment 7 has a diffuse apical dorsal spot tapering basad. 8 to 10 are reddish yellow and the sides of 8 and 9 are only slightly dilated.

Anal appendages short, conical, pointed, yellow.

Hind femora armed with a row of rather widely spaced, robust, gradually lengthening spines, mid femora with similar but more closely set and smaller spines, black, both pairs with a close field of spines on inner side.

Distribution. Laidlaw records a male from Agra and I have examined a female taken at Pusa: 16. VII. 20, which is quite complete. (In Pusa Mus.)

Rambur's type is an incomplete female labelled "India, Stevens." Type and paratypes in Selysian collection, paratypes in Indian Museum and Pusa collections. The insect is apparently very rare and confined to Central and North India.

**Mesogomphus lindgreni** sp. nov.

Male : Abdomen with appendages 39 mm. Hindwing 29 mm.

Head: Labium whitish green; labrum greenish yellow, broadly black at the base; mandibles similarly coloured; anteclypeus and postclypeus greenish yellow, the latter clouded with black on either side of the middle line; frons greenish yellow with a streak of black along its crest and the base above broadly black; vertex black; occiput very dark brown, *its border bearing no spines*, entirely naked save for a few hairs at each end.

Prothorax black.

Thorax greenish yellow, black markings similar to those of *lineatus* but much more extensive, the antehumeral and humeral stripes coalesced and obliterating the ground colour between them save for a small upper spot, similarly the two lateral stripes coalescent, forming one broad black stripe and leaving a mere vestige of the ground colour above.

Wings evenly enfumed, *costa and pterostigma black*; reticulation black; 3 nervures between *Mi-iii* and *Miv* in the forewing, 1 or 2 in the hind; discoidal field of even width till well beyond the node; nodal index:— $\frac{8.13}{8.9} | \frac{13.8}{9.8}$ .

Legs black save for a spot of yellow behind the proximal end of each femora, coxæ and trochanters yellow.

Abdomen black marked with yellow as follows:—segment 1 entirely black save for a small postero-lateral spot, segment 2 with a broad line on the mid-dorsal carina and the sides including the oreillets, the black sending a prolongation down behind the latter structures as in the case of *lineatus*, segments 3 to 7 with the basal half yellow, the lateral border of this colour running obliquely from the m.d-dorsum to reach the ventrum of each segment just proximal to the jugal suture, segment 8 with only a largish baso-lateral spot and a fine apical yellow annule, the large, lateral foliate dilatations with an apical spot of yellow, segment 9 with the lateral dilatations entirely yellow and an angulated spot on the ventro-lateral and baso-lateral border, segment 10 with a greenish yellow diamond shaped spot on the mid-dorsum, otherwise deep black.

Anal appendages black, very similar to those of *lineatus*, superior as long as the 9th and 10 segments taken together, exactly similar to those of *lineatus* as seen in profile, but seen from above there is a distinct linear gap between them for rather more than basal half. The apical portions closely apposed, the apposed surfaces quite flat, thus resembling a pair of closed forceps. Inferior appendages smaller than in *lineatus*, more curled on themselves and passing up between the superiors, thus enclosing a tiny round foramina.

Genitalia. Lamina shallow, more depressed than in *lineatus*, its border not curling outwards, black; inner hamules more conical, broad at base and tapering to a terminal, hook; outer hamules stout hooks, more robust than in *lineatus* and without the subapical spine; lobe directed out at right angles to axis of body, more prominent, its outlet more closed in and less indented at the apex than in *lineatus*, black.



*Hab.* A single male taken by Mr. O. Lindgren, Turzum, Darjeeling Dist. Very easily distinguished from *M. lineatus*, to which it is very closely related, by the great extent of black markings, by the black costa and pterostigma, by the absence of spines on the occiput and by the lack of specialization of neurulation between *Mi-iii* and *Miv*, by the genitalia (lamina black, stout hamules and projecting lobe) and lastly by the anal appendages. Female unknown.

I have much pleasure in naming this fine species after Mr. Oscar Lindgren.

**Mesogomphus risi** sp. nov.

Male (Female unknown). Abdomen with appendages 27 mm. Hindwing 26 mm.

Head. Labium pale yellow, middle lobe rather blackish; labrum pale yellow, its base and lateral borders deep black; anteclypeus and postclypeus pale yellow, the latter with a broad black bordering at its central third; mandibles pale yellow; frons deep black in front, bright, citron yellow above, its base deep black and sending a fine medial prolongation forwards in the sulcus to join the black on front of frons; vertex and occiput black, the latter with a broad yellow stripe traversing it, fringed with whitish hairs and a few minute black spines.

Prothorax blackish brown, yellow on the sides.

Thorax black with bright citron yellow markings as follows:—a mesothoracic collar broken in the middle line, oblique pyriform dorsal spots, pointed below and not joining the mesothoracic collar, a minute humeral spot on each side above and a vestige of a stripe below separated from it but in the same straight line; laterally a broad medial black stripe dividing up the sides into three areas of even width, two yellow and one black.

Legs black, anterior femora yellow on the inner side, hind femora with a row of very small, very closely-set, numerous black spines, mid femora with a row of much more robust, less closely-set, less numerous spines.

Wings (badly damaged and shrivelled) hyaline, costa finely yellow, reticulation and pterostigma black, the latter braced; 2 nervures between *Mi-iii* and *Miv* in the forewing, only one in the hind; discoidal field of even width to

beyond the level of node; nodal index:—
$$\frac{7-12}{7-9} \bigg| \frac{13-6}{9-6}.$$

Abdomen shaped as in *lineatus* but much shorter, jet black marked vividly with bright yellow rings, segment 1 with the apico-lateral border yellow, segment 2 with a middorsal stripe expanding apically but not quite meeting the apex of segment, its ventro-lateral borders rather broadly yellow, segments 3 to 7 with the basal halves yellow, this colour running obliquely from the mid-dorsal carina to meet the ventral border just proximal to the jugal suture, segments 8 and 9 with only the foliate dilations bright yellow, 10 black with a small middorsal subapical spot.

Anal appendages black, the superior turning to yellow near the base on the outer side; very similar in shape to those of *lineatus*. Superior as long as segments 9 and 10 taken together, rather straighter, the apex curled more abruptly and the final point directed back towards the abdomen; seen from above separated in rather more than the basal half, the ends closely apposed. Inferior rather more than one third as long, rather less curled and the apex longer than in *lineatus*.

Genitalia. Lamina very shallow, very depressed, border barely concave, yellow; inner hamules comparatively short, broad at base and rapidly tapering to a point, black; outer hamules very long, almost twice the length of inner, very robust, their ends converging and curled in a very robust spine just below the apex on its inner side (much more easily seen than in *lineatus*), black; lobe very similar to *M. lindgreni*, black directed somewhat outwards, deeply indented at apex outlet squarish but not nearly so deep as in *lindgreni*.

*Hab.* A single male from Burma, Kalaw, S. Shan States taken by Mr. G. Dingavan. The species is very distinct from others by its very small size (the smallest species of the genus) and by its brightly contrasted markings, by its black pterostigma, etc. I have named the species after Dr. Ris in recognition of his work on the genus.

Genus—ONYCHOGOMPHUS (Selys 1854, restrict).

(=Genus—ONYCHOGOMPHUS groups—GEOMETRICUS, UNCATUS, FORCIPATUS, AND CERASTES Selys.)

*Lindenia* De Haan, Bijd, Nat Wetensch i. (2) p. 47 (1826); Hoev. op. cit. 111 p. 333 (1828).

*Diastatomma*, p., Burm. Handb. Ent. ii. p. 831 (1839); Charp. Lib. Eur. p. 15 (1840.)

*Onychogomphus*, Selys, Bull, Acad. Belg. xxi. (2) p. 30 (1854); Mon. Gomph. p. 15 (1857).

*Lindenia*, Kirby, Cat. Odon p. 57 (1890).

*Onychogomphus*, Will Proc. U.S. Nat. Hist. Vol. XXXIII, pp. 308-315 (1908); Laid. (Sections I, III, and V,) Rec. Ind. Mus. Vol. XXIV, p. 402 (1922).

Moderately large insects with ground colouring bright yellow marked with black (or rarely, black marked with yellow); pterostigma large, but not as long as one fourth the distance between node and distal end of pterostigma; discoidal field in forewing narrow, only beginning to dilate at or after the level of node; anal loop very small, consisting of the first anal cell which is divided into two cells; 2 or 3 cross nervures between *Mi-iii* and *Miv* in forewing, only 1 in the hind; legs short, extending to the posterior border of thorax when apposed; abdominal segments 8 and 9 or 9 only a little dilated, no foliate processes as in *Mesogomphus*. Anal appendages of equal length, or the inferior slightly shorter than the superiors, usually about as long as the two last segments of abdomen taken together, superiors only slightly separated, parallel, inferior deeply cleft into two contiguous branches (in *O. williamsoni* the inferior appendage is abnormal and has divaricate branches); genitalia very similar in all species, lamina depressed, inner hamules very fine hooks of variable length, usually rather long and with a fine outturned point, converging gently on each other, external hamules more robust and relatively shorter, ending in a robust point, lobe projecting, funnel or bottle shaped (in *O. duaricus* and *striatus* it is rather broader and more depressed); vulvar scale very similar to that of *Mesogomphus* (except in *O. M-flavum* in which it is abnormally prolonged as far as 10th segment).

Larvae unknown. Genotype *O. forcipatus* Linn.

The genus as restricted here, contains a number of species whose position in the genus is very doubtful. No less than three species are known from females only and a fourth from two incomplete males, so that we are entirely ignorant of the character of the anal appendages of these, a very serious disadvantage when dealing with the genus. A fifth species described by Mr. Williamson has the inferior appendage divaricate, a character quite unique in the genus and therefore throwing some doubt as to its correct placing. *O. circularis* Selys has the superior appendages strongly curved circle-wise in the horizontal plane, very much as in genus *Heliogomphus* to which it may possibly belong. *O. modestus* differs from all others by its general black colouring and small size (equal to that of *Microgomphus*). Selys considered it as related to *O. saundersi* but it is difficult to see on what grounds as the size is one third smaller and the genitalia are quite different. Laidlaw basing his opinion on the great extent of black colouring and the shape of the anal appendages which compare favourably with those of *acinaces*, thinks that it may belong to group *biforceps* (*Lamellogomphus*), its very small size and the vesiculated genital lobe seem however



to bar it from that group. Nor are we at all helped by venational characters, as Selys has given us no data to go upon, we are thus left with only the character of the markings to base our diagnoses on.



Explanation of Fig. 2.

Latero-ventral view of genitalia of:—i. *Heterogomphus hannyingtoni* ii. *Gomphidia fletcheri*, iii. *Gomphidia kodaguensis*, iv. *Gomphidia williamsoni*, v. *Oychogomphus M-flavum*, vi. *Onychogomphus striatus*, vii. *Onychogomphus duaricus*, viii. *Onychogomphus dingavani*, ix. *Ictinus rapax*, x. *Lamellogomphus inglisi*, xii. *Mesogomphus lineatus*, xi. Vulvar scale, ventral view, of female of *Onychogomphus M-flavum*.

The female described by Laidlaw from Kumaon is undoubtedly *bistrigatus*. I have a male which compares as closely with this specimen as it does with the Selysian description in the Monograph of the type female of *bistrigatus*. Laidlaw has evidently overlooked in this description, the mention of a character on which he lays so much stress, *viz.*, the yellow neurulation at the base of the wings. This character is strongly developed in the male mentioned above. The confusion which has arisen between the descriptions of *M-flavum* and *bistrigatus* has already been correctly interpreted by Williamson and Laidlaw, it is unfortunate that Selys did not give us the character of the vulvar scale in the adult female mentioned in the Monograph and that the end of the abdomen is missing from the Vienna Museum specimen, the shape of the organ in *M-flavum* is so characteristic that a knowledge of these points would have obviated any error.

The male from Kallar mentioned by myself in the Records, Indian Museum, I.c., differs rather more from the female of *bistrigatus*, than does the male mentioned above, and the neurulation is black. Moreover its genital lobe varies considerably from all other members of the genus except *duaricus* so that I have described it below as a new species under the name of *striatus*.

**Onychogomphus bistrigatus** Selys, (*Gomphus bistrigatus*) Bull. Acad. Belg. xxi (2), p. 31 (1854); Mon Gomph. p. 22 (1857); Will. I. p. 309 (1908); Laid. I.c. p. 410 (1922), id. ibid. (*Onychogomphus sp.*) pp. 411-412.

Male: Abdomen 36+3 mm. Hindwing 3i mm.

Head. Labium pale whitish yellow; labrum yellow very finely margined with black anteriorly and at the base; clypeus, base of mandibles and frons yellow, a fine black line between the frons and post-clypeus incomplete laterally and sending two fine points down on either side the middle line; base of frons narrowly black with but the slightest prolongation in the middle line; vertex black, a small spot of yellow between the posterior ocelli; occiput slightly convex, yellow with the postero-lateral angles black, fringed with yellow hairs; behind occiput and eyes yellow, a narrow black line margining the latter above.

Prothorax black, its anterior and posterior borders narrowly and two fine approximated points yellow.

Thorax black on dorsum marked with yellow as follows:—the median part of the dorsal carina narrowly, a mesothoracic collar slightly interrupted in the middle line, oblique antehumeral stripes joined to the mesothoracic collar, complete humeral stripes slightly constricted just below their upper end, laterally yellow with two fine black lines mapping out the sutures.

Legs yellow, the anterior femora broadly black on the outer side, the middle with a fine black line and the hind pair with but a vestige of same on outer side; tibiae black on the flexor surface, femora armed with a row of robust short, closely-set black spines and a single larger one at the distal end.

Wings hyaline with a greenish yellow tinge, neurulation black but a large number of cross-nervures proximal to the node and on fore-part of wings bright yellow. Pterostigma dark brown, well-braced, over 3-4 cells; costa to half way over stigma pale yellow; nodal index:— $\frac{10-13}{8-10} \mid \frac{14-9}{10-10}$ ; 2 cross nervures between *Mi-iii* and *Miv* in forewing, only 1 in the hind, first postanal cell undivided in both hindwings, (but this is probably an aberration as the network is very irregular).

Abdomen black and yellow, segment 1 with a quadrate subdorsal black spot not reaching the apex of segment; 2 with broad subdorsal black stripes barely reaching the apical border and enclosing a dorsal lobed spot of yellow, a tongue of black running down behind each auricle; 3 yellow with a broad black stripe on each side falling well short of the basal end of segment and coalescing beneath the ventrum, above a subbasal and subapical tongue of black running up over the dorsum almost coalescing over the carina and enclosing a medial



spot of yellow; on 4 to 6 the same markings but here the black processes coalesce over the middorsal carina and the apical band extends right up to the apical border; 7 yellow with a black dorsal stripe, very broad at the apex of segment where it sends a tongue-like process back along sides of segment, tapering rapidly on the dorsum and extending to extreme basal end of segment; 8 to 10 yellow, broadly black on dorsum, the yellow however constricting the black on segment 10 so as to almost cut it in two at the apical border. Apical borders of last three segments finely black and bordered with black spines.

Anal appendages yellow, of nearly equal lengths, as long as last two abdominal segments taken together, the superiors separated but parallel, their apices broadly flattened (lancet-shaped), turned rather abruptly down and a little in; the inferior cleft nearly to its base into two closely contiguous branches, nearly straight, the apex-turning up, bearing a robust blunt spine at the outer end of the middle third and another similar spine near the apex, both very prominent when appendages viewed in profile.

Genitalia: Lamina yellow, depressed, its border angulated outward so that it appears rather deeply cleft; inner hamules broad at base, deeply cleft into two branches, an outer short spine and an inner, long thin spine which is everted sinuously at its apex, seen from the front converging rapidly on each other, black; outer hamules very stout and short, yellow tipped with a blackish brown, robust, forwardly-directed spine; lobe funnel-shaped, with broad opening, pale yellow narrowly margined with black.

Female: Abdomen 39mm. Hindwing 31 to 34 mm.

Very similar to the male. A comparison of the male and two females reveals the following slight differences which are merely those of degree in extent of black markings, differences probably due to the varying age of specimens.

The type female does not appear to have a basal black line to the labrum, whilst on the other hand the specimen from Kumaon has no similar border anteriorly (both borderings in the male are however extremely narrow, the anterior barely visible with the unaided eye, so that these may have been overlooked in the descriptions of the females.) The occiput in the type female is bordered with a row of six tiny spines, which are absent in the Kumaon specimen.

Prothorax of type and the male similar but the two small dorsal spots absent in the Kumaon specimen.

Thorax and legs similar in all three specimens.

Abdomen. Segment 1 entirely yellow in the Kumaon specimen, marked with black in the type female and male, segment 2 variable, the subbasal black bands not meeting the apical border in the type, barely separated from it in the male and confluent with an articular black ring in the Kumaon female, segments 3 to 6 similar in the sexes (segments 4 to 6 missing in the Kumaon specimen) but the black extensions not quite meeting over the carina in the type, and 7 very similarly marked to the other segments.

Wings hyaline, many pale yellow nervures in both females similarly situated as in male; nodal index, 13-16 antenodal nervures in forewings, 10 in the hind, 10 postnodals in the forewings, 12 in the hind.

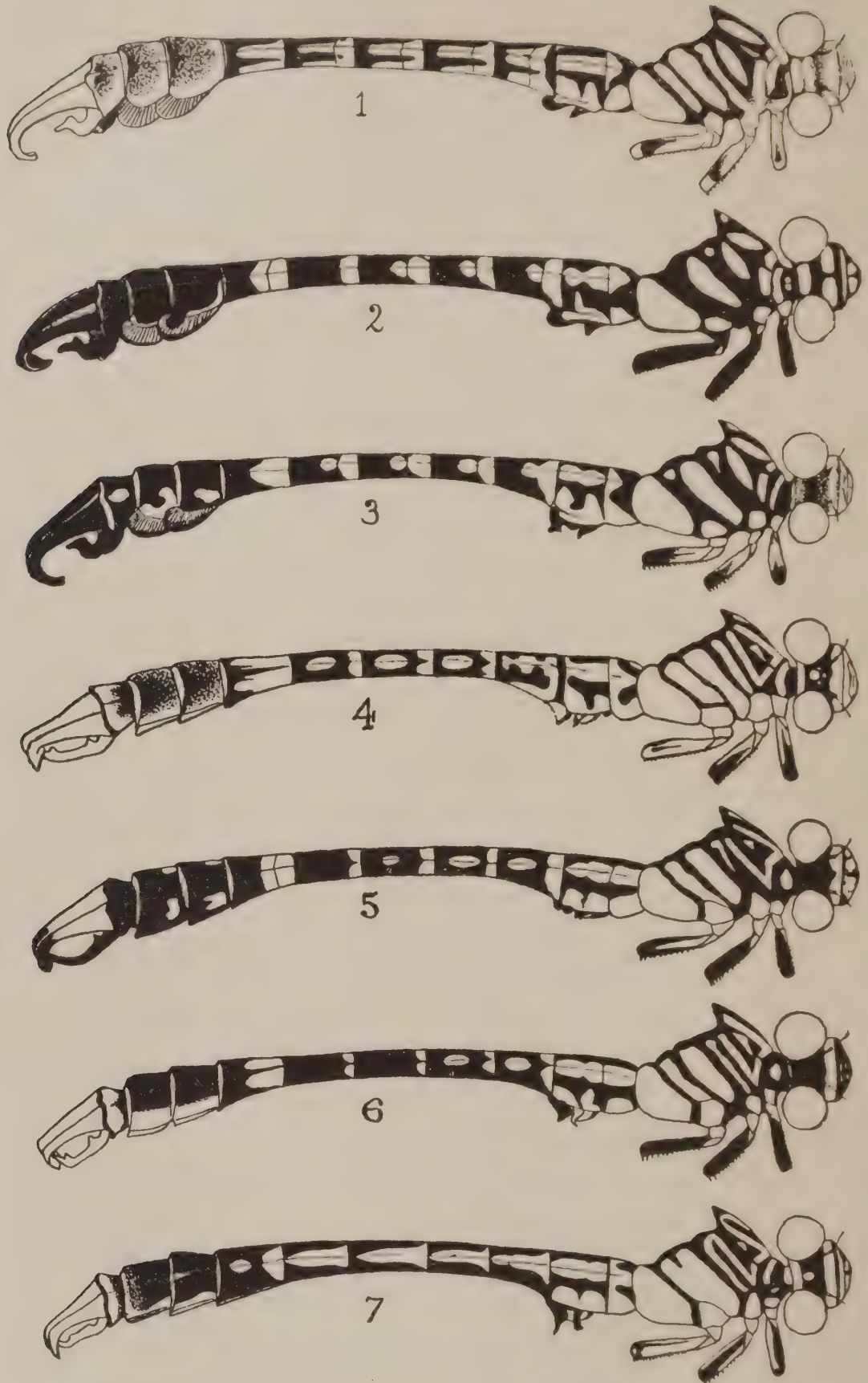
Anal appendages of female as long as segment 10, conical, pointed, separated by a conical protuberance of shorter length than appendages, yellow.

Vulvar scale short, about half the length of segment 9, deeply notched at apex into two subtriangular processes.

*Hab.* Type female in the Selysian collection from "India", cotype male in my own collection from Gopaldhara, Assam, collected by H. Stevens, 21 IX. 20. (Will be eventually deposited in the B.M.) Laidlaw's female is from Kumaon N.E. Himalayas.







EXPLANATION OF PLATE II.

1. Dorso-lateral view of *Mesogomphus lineatus*, Male.
2. The same of *Mesogomphus risi*, Male.
3. The same of *Mesogomphus lindgreni*, Male.
4. The same of *Onychogomphus bistrigatus*, Male.
5. The same of *Onychogomphus duaricus*, Male.
6. The same of *Onychogomphus M-flavum* (Type Male).
7. The same of *Onychogomphus dingavani*, Male.

**Onchogomphus striatus** sp. nov.

*Onchogomphus bistrigatus* Fras. Rec. Ind. Mus. Vol. XXIV, p. 424 (1922).

Male: Abdomen 34+3 mm. Hindwing 28 mm.

Very similar to *bistrigatus*, differs as follows:—

Size slightly smaller; labrum more broadly bordered with black anteriorly; postclypeus entirely black at its centre, with a very large yellow spot on each side; vertex as for *bistrigatus*; occiput with its border quite straight and turned forward so that its posterior surface can be seen when the head is viewed from above, black with a narrow yellow border, fringed with long black hairs.

Prothorax similar but without the middorsal spots.

Thorax. Humeral stripes tapering away below to a point and not confluent with the yellow of thorax below. Lateral black lines on sutures rather thicker.

Wings with black reticulation, no pale yellow nervures present; nodal

index:— $\frac{9-13}{9-9} \mid \frac{12-10}{10-10}$ : 2 rows of cells between *Mi* and *Mia*; first postanal cell divided; pterostigma pale brown, rather weakly braced.

Legs as for *bistrigatus* but tibiae black except at proximal ends.

Abdomen. Segment 1 black with a large lateral yellow spot, 2 with a narrow complete basal black ring and broad subbasal black stripes broadly confluent with the apical articular black ring, segments 3 to 6 with the yellow reduced to a complete but irregular basal ring and a median dorsal spot, 7 with its basal half yellow, 8 and 9 black with a large yellow spot on each side, 10 entirely black.

Anal appendages yellow, the inferior rather darker coloured and the superiors with a fine black line along the upper surface of the apical third. Almost exactly similar to those of *bistrigatus* but with the apices of superiors almost cylindrical, not flattened out lancet-wise as in that species.

Genitalia: Lamina blackish brown, its dorsum with a longitudinal keel, its border concave, neither everted nor angulated; inner hamules more shallowly notched, the inner branch not much longer than the outer and much shorter than in *bistrigatus*, its apex tipped with yellow; outer hamules dark brownish yellow, similar in shape to those of *bistrigatus*; lobe black, prominent but not markedly so, its border thickened, hollowed out medially, the extremities of the notch forming rounded bosses.

*Hab.* A single male from Kallar, Nilgiris, about 1,000 ft., May 1917. The species differs from *bistrigatus* by the greater extent of black markings and by the shape and colouring of the superior anal appendages and genitalia and lastly by the reticulation being entirely black.

**Onchogomphus duaricus** sp. nov.

Male: Abdomen 33.5 to 37.5+3.5 mm. Hindwing 31 mm.

Head. Labium pale whitish yellow; labrum greenish yellow, the base narrowly, the anterior border broadly black and sending a point up which may nearly or entirely cut the yellow in two by meeting the black of base (in the majority of *Gomphinae* we usually find a tongue of black running down from the base, the opposite condition found in this species is quite exceptional); anteclypeus and base of mandibles greenish yellow, postclypeus black with a small triangular spot of greenish yellow each side against the eyes; frons greenish yellow, its lower part in front black this confluent with the black of postclypeus, its base very finely black and a number of fine black points scattered about its crest; vertex and occiput black, border of latter nearly straight, not raised, fringed with long black hairs.

Prothorax black with a small lateral spot of yellow.

Thorax black on dorsum marked with yellow as follows:—a mesothoracic collar narrowly broken by the black dorsal carina which is narrowly yellow at its middle, antehumeral oblique stripes connected to the collar below, humeral



stripes variable, clubbed above, tapering to a fine point below (In some specimens the tapered part is cut off from the upper part of stripe and in others it breaks up into a chain of fine points); laterally greenish yellow, the lateral sutures boldly mapped out in black, the anterior stripe connected to black of dorsum by a line descending from latter.

Legs black, hind femora with a broad yellow stripe on inner side, furnished with a row of closely-set, robust short black spines, the mid femora with a similar row.

Wings distinctly tinted with greenish yellow especially towards the base; costa finely yellow nearly as far as pterostigma which is deep brownish black, well-braced, over 5 cells; antenodal nervures and arc yellow; postanal cell divided; 2 to 3 rows of cells between *Mi* and *Mia* at level of outer end of stigma;

nodal index  $\frac{10-15}{11-12} \frac{17-10}{12-11} \frac{12-16}{12-13} \frac{18-11}{12-11}$ ; 2 cross nervures between *Mi-iii* and *Miv* in forewing, only one in the hind; only 2 cells between *Cui* and *Cuii* at wing margin in hindwing.

Abdomen black marked with yellow as follows:—Segments 1 and 2 with a broad continuous dorsal lobed stripe, tapering at the apical end of segment 2 and bordered with a broad subdorsal band of black which is confluent with a narrow apical articular ring on segment 2, a short apical process of black occasionally runs along border of 1 and another behind the oriellets on segment 2. Ventral border of latter segment furnished with a row of small black spines. Segments 3 to 6 with clear yellow basal rings covering rather less than one fourth the length of segments, on 3 to 5 middorsal oval spots of yellow, almost obsolete on 5, absent entirely on 6, segment 7 with the basal half yellow, its crest finely black, 8 and 9 with lateral yellow spots, bifid posteriorly, 10 entirely black. Legs black except for stripe on innerside of first femora.

Anal appendages. Superior bright yellow, the apical third or more abruptly black, inferior black with the upper surface sometimes paler. Superior similar in shape to those of *bistrigatus*, parallel, converging at apices which are rather sharply turned down and compressed; inferior cleft nearly to the base, curved rather abruptly at their middles so that their apices lie between the superiors, a stout tooth on the upper border close to the base, *no apical tooth*.

Genitalia differing rather from that of other species except *striatus*. Lamina black, keeled only in its posterior half, depressed, but shallowly notched; inner and outer hamules of the same length, the inner long tapering black spines, the apices only slightly everted, the outer much stouter, directed straight out perpendicular to body axis, the apex curled and finally directed forward, yellow at base, black at apex; lobe rather prominent, borders tumid, similar in shape to *striatus*.

Female: Abdomen 40 mm. Hindwing 33 mm.

Very similar to the male, differing as follows:—Yellow on labrum not quite bisected by black; black at base of frons extends a short way into floor of sulcus; occiput black and similar to male in shape; yellow on middorsal carina meeting the mesothoracic collar which is uninterrupted; humeral stripe complete below and connected with the elbow formed by the junction of mesothoracic collar and antehumeral stripe; sides of segments 1 and 2 more broadly yellow, the black sub-dorsal bands narrower and with straight borders; no dorsal spots on segment 4, the basal yellow on segment 7 more restricted; spots on sides of 8 and 9 absent.

Anal appendages pale yellow, almost white, conical, pointed, rather longer than segment 10, the protuberance between them pale yellow.

Legs with all the femora striped on the inner sides with yellow, the spines on hind femora much less numerous, longer, more widely-spaced and more robust than in the male.

Wings with the greenish tinting more marked especially towards the base; 2 to 3 rows of cells between *Mi* and *Mia*, usually only 2 rows; nodal index  $\frac{11-17}{10-12} | \frac{17-11}{13-11} | \frac{11-17}{12-12} | \frac{17-10}{12-11}$ ; 2 rows of cells in anal area of forewing.

Vulvar scale aborted, only perceptible as two rudimentary rounded shiny tubercles, the remnants of a bifid scale.

*Hab.* Hasimara, Duars, Bengal. Several pairs collected by Mr. H. V. O'Donel to whom I am indebted for this beautiful species. Type male and cotype female in the British Museum.

The following combination of characters will distinguish this species from all others:—the unusual distribution of black on the labrum, the black occiput, the wide space between *Mi* and *Mia*, the shape of the genitalia in both sexes, the striking colouration of the superior anal appendages and the presence of only one tooth on the inferiors.

***Onychogomphus M-flavum*** Selys. *Causeries Odonatologiques* No. 7, Ann. Soc. Ent. Belg. pp. 163-181, 1894;

*Onychogomphus bistrigatus*, Mon Gomph. pp. 24, 392, (1857); *Gomphus bistrigatus* Bull. Acad. Belg. XXI (2), p. 46 (1854); *Onychogomphus M-flavum*, Will. l.c.p. 309; Laid. l. c. 410, 411.

Male: Abdomen 35+3 mm. Hindwing 30-33 mm.

First male: Head. Labium dirty yellow; labrum greenish yellow, very narrowly bordered with black at the base, more broadly along the anterior border, a narrow streak of black running from its centre, of even width, not quite reaching the black on anterior border; base of mandibles, anteclypeus and a narrow bordering on lower edge of postclypeus yellow, latter black with a large greenish yellow spot on each side; lower part of frons black, this confluent with the black of postclypeus, upper part and above greenish yellow its base narrowly black; vertex and occiput black but a broad streak of greenish yellow on posterior half of latter, its border slightly convex in the middle, and turned forward so that the hinder surface is easily visible when the head is viewed from above, back of eyes black, of occiput yellow.

Prothorax yellow with a large triangular spot of black on each side.

Thorax black on the dorsum marked with bright greenish yellow as follows:—a mesothoracic collar broken by the black of middorsal carina, which is itself bright yellow somewhat higher up; antehumeral oblique stripes confluent with the collar, complete humeral stripes constricted a little below the upper part; laterally greenish yellow, the sutures outlined rather finely in black and on the first suture showing two interruptions which cut off a small part of the line opposite the spiracle.

Legs black, the anterior femora yellow within, the mid femora similar but with a narrow interrupted streak on the outer side, hind femora with broad streaks of yellow on both sides and furnished with a row of short robust closely-set black spines.

Wings hyaline faintly tinged with greenish at extreme base; pterostigma dark brown margined heavily with black nervures (much paler in teneral specimens and black in very adult), over 4-5 cells, well-braced; nodal index:— $\frac{15-14}{15-12} | \frac{15-13}{13-14} | \frac{12-15}{13-11} | \frac{15-12}{11-13}$ ; 2 rows of cells in anal area of forewing; only 1 row of cells between *Mi* and *Mia* except at extreme margin of wing; 2 cross nervures between *Mi-iii* and *Miv* in forewing, only 1 in hind; first postanal cell irregularly divided; costa finely yellow as far as stigma but this colour lost in very adult specimens.

Abdomen black marked with bright yellow, more ochreous towards the end segments, as follows:—segments 1 and 2 with a dorsal lobed stripe extending from base of 1 to apical border of 2 and separated from the yellow of sides by a



moderately broad stripe of black which sends a stripe down behind the oreillets segment 3 has a complete basal ring prolonged both along the ventrum and dorsum and confluent on latter with a large irregularly angulated dorsal spot, on 4 to 6 the basal rings less extensive laterally and partially bisected by an invasion of the black along dorsal carina, the middorsal spots smaller, oval and isolated from the basal rings, segment 7 with the basal two thirds yellow, 8 with the lower half of the sides, 9 with only a clouding of black on dorsum, 10 ochreous its apical margin finely black. All segments from 3 to 10 with an apical ring of fine black spines.

Anal appendages golden yellow, the superior a little darker, very similar to those of *bistrigatus*, broad at base, cylindrical and tapering to apex which is rather more sharply angulated downwards and inwards and compressed; branches of inferior about two thirds the length of superior appendages, closely contiguous and parallel, the apical third curved up, a robust tooth on upper border near the base and a second near apex.

Genitalia: Lamina very depressed, its border much everted, arched and folded back on itself, dark brown; inner hamules of great length and very attenuated, converging, the outer branch also elongate, black; outer hamules broad, of about the same length, yellow with a robust apical spine; lobe black, projecting prominently like an open spout.

Second and type males.

Differing from the first described male by the much greater extent of black. Anteclypeus, vertex and occiput entirely black; no median short black stripe on labrum; prothorax almost entirely black; humeral stripe interrupted above in the second male, entire in the type; lateral lines of thorax complete; costa yellow in second male, black in the type; pterostigma blackish brown; yellow on sides of segment 2 nearly cut into two by a prolongation of the subdorsal black, completely cut into two in the type; medial spot on dorsum of segment 3 small and completely isolated, almost obsolete on 4 in the second male, completely so in type; only narrow basal lunules on segments 5 and 6; 7 with only its basal half yellow and this divided by a narrow black dorsal carina, 8 and 9 broadly reddish yellow on the sides, the miniature lateral wings black, 10 reddish yellow finely margined with black along apical border.

Legs black, only the anterior femora marked with yellow within.

Female: Abdomen 39 mm. Hindwing 32-36 mm.

Very variable, differing not only from the males described above but also individually in the sex.

Labrum finely or broadly bordered with black which may be more extensive than the yellow; anteclypeus dark brown or light greenish yellow, postclypeus black marked with a small lateral yellow spot or else almost entirely greenish yellow marked only with a small quadrate black spot at the middle of its posterior border; the black stripe at base of frons and that bordering it below in front very narrow or very broad; vertex black or black marked with a small spot of yellow between the posterior ocelli; occiput brownish in the type, black with a small central spot of yellow or entirely bright yellow in others, its border almost straight and yellow behind as in male; humeral stripe complete or occasionally broken at its upper part, the first lateral line on thorax complete or widely interrupted in one specimen as in the male described above.

Legs very variable, black marked with a variable extent of yellow, the hind femora armed with a row of very robust, very widely-spaced, long black spines.

Abdomen very similar in all specimens examined and to the type male and cotype female, the black on segment 1 reduced to a mere subdorsal vestige or entirely wanting, segment 2 in two females examined, with a large lateral isolated black spot, on segments 3 to 6 the basal yellow very broadly confluent with the middorsal spots and extending almost to apical border of segments as a broad

dorsal stripe; remaining segments as for male but the yellow very dark reddish or ochreous.

Anal appendages and protuberance between them rather dark yellow, short, conical.

Vulvar scale very highly specialized and differing from any other species of the genus, shaped like an acuminate leaf, very long, extending to the middle of segment 10, cleft for rather more than its apical half into two closely contiguous halves, reddish brown, black at apex, very thin when viewed in profile, its surface raised into two longitudinal folds.

Wings slightly enfumed; pterostigma dark brown or blackish, over  $4\frac{1}{2}$ - $5\frac{1}{2}$  cells; nodal index  $\frac{11-16}{13-11}|\frac{15-13}{11-11'}|\frac{12-16}{14-12}|\frac{15-13}{12-14'}|\frac{13-17}{12-13}|\frac{17-13}{13-13}$ ; reticulation as for male but in one female 2 rows of cells between *Mi* and *Mia* nearly as far as stigma; costa black in one female, yellow in another.

*Hab.* Gopaldhara, Assam, Darjeeling District. I am fortunate enough to possess two males and three females and have seen a few others all taken at the same time and place by Mr. H. Stevens. The remarkable shape of the female ovipositor leaves no doubt as to their correct identity, and it is only reasonable to presume that the males are related to them. At first sight it would appear that the first male differs so markedly from the second and type males that it cannot be conspecific but if we compare the three males with the females described above, we find all the variations met with in the former, reproduced in the latter.

The male and female described as *O. M-flavum* in the Rec. Ind. Mus. by Laidlaw, undoubtedly belong to that species, the differences between them and the type noted by the author being explained away similarly.

The female is easily distinguished from all others by its remarkable ovipositor but greater difficulties are met with in distinguishing the males. From *duaricus* the unicolourous superior appendage and inferior with two teeth will serve to distinguish it; from *bistrigatus* the all-black reticulation, the greater extent of yellow on segment 7 and the lobe of genitals matt black; from *striatus* the complete humeral stripe (tapering rapidly away in the latter), the much narrower lateral lines on sides of thorax and the shape of the apices of superior anal appendages and lastly the shape of the genital lobe.

#### ***Onychogomphus dingavani* sp. nov.**

Male: Abdomen 32+3 mm. Hindwing 28 mm. Pterostigma 3 mm.

Head. Labium palest yellow; labrum greenish yellow, its anterior border narrowly black and an obscure central black line not quite reaching its base; anteclypeus yellow, postclypeus black with a large greenish yellow spot on each side; frons greenish yellow margined below the front with black which is confluent with the black of postclypeus, its base broadly and evenly bordered with black; vertex black with a small spot of yellow between the posterior ocelli; occiput bright greenish yellow, broadly yellow behind, its border quite straight and fringed with long brownish hairs; eyes black behind.

Prothorax black with an anterior collar, the posterior lobe, a small duplicated spot on the dorsum and a linear one on the sides yellow.

Thorax black on dorsum marked with greenish yellow as follows:—a mesothoracic collar broadly interrupted by the black dorsal carina which is narrowly bright yellow a little above for about its middle third; antehumeral oblique stripes confluent with the collar, complete humeral stripes curling in above where they become confluent with the antehumeral stripes, but slightly disconnected from the yellow of thorax below.

Laterally greenish yellow with the remnants of an anterior lateral line on the upper part of the first lateral suture and a complete narrow black line mapping out the postero-lateral suture.



Legs yellow marked with black, the first and second pairs of femora entirely black on the outer side, the hind with only a narrow stripe not extending as far as base. Flexor surface of hind femora thickly covered with small but robust spines, the middle femora with a row of widely spaced, more robust, longer spines.

Wings faintly and diffusely tinged with greenish yellow; nodal index:—

11-14|14-13

12-10|10-12;

only one row of cells between *Mi* and *Mia* to within two cells of wing margin; 2 rows of cells in anal area of forewings; first postanal cell in hindwings undivided; *Cui* and *Cuii* with a single row of cells between, to within 4 cells of wing margin; pterostigma well-braced, over 4-5 cells, dark brown; costa yellow as far as stigma as also are many of the cross nervures in fore part of wings, the antenodals, the arc and in spaces running out from it.

Abdomen black marked with yellow as follows:—segments 1 and 2 with broad subdorsal black stripes of even width enclosing a lobed dorsal stripe of yellow, sides of both segments broadly yellow including oreillets, a black articular ring on segment 2; segment 3 with a narrow basal ring confluent with a short ventral stripe and a broad dorsal stripe with crenulate borders which extends to the apical border; segments 4-6 similar but the basal rings limited below and no ventral stripes; 7 with the yellow extending apically along the dorsum for two thirds the length of segment and black for the same length along the sides, the ventrum yellow; 8 and 9 with the sides broadly and the apical border of 9 narrowly yellow, 10 with its basal fourth black, the rest yellow, 9 and 10 with a fine apical border of black fringed with minute spines.

Anal appendages yellow, the inferior only slightly shorter than the superiors. The latter broad at base, cylindrical and tapering to the apex which is evenly and strongly curled down, separated at base, converging at apices. Inferior deeply cleft into two closely contiguous branches, at first curling down and then running nearly horizontally to the apices which are rather abruptly curled up, passing between the ends of the superiors. A robust tooth on upper surface close to the apex, basal third cylindrical and then abruptly thickened to nearly as far as apical tooth (the thickening begins at the site of the basal tooth in *M-flavum* and is really a continuation of this tooth).

Genitalia: Lamina low, shaped like that of *M-flavum* deeply arched, brownish; inner hamules fine, divergent (this may be because the penis is erect between them), of great length, passing down between the outer hamules nearly as far as lobe; outer hamules robust, yellow at base, black at apex, perpendicular to the body axis, ending in a robust forwardly directed spine; lobe matt black, projecting prominently like the spout of a tea-pot.

*Hab.* A single male from Kalaw, S. Shan States, Burma, collected by Mr. G. Dingavan (in slightly damaged condition). The humeral stripe confluent above with the antehumeral, the shape of the inferior anal appendages and the genitalia will serve to distinguish this species from all others of the genus.

( To be continued. )

#### NOTE.

In Part XVII, Indian Dragonflies, the explanation of Plate I, page 680, has been wrongly given as the explanation of Plate II and the explanation of Plate II as that of Plate I, the order should be reversed.







*H. S. Photo.*

RIDGE IN NEPAL.

Below Kalo Pokhari. 15th April, 1912.



*H. S. Photo.*

KALO POKHARI.

Camp 10,160'. 15th April, 1912.

## NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS.

By

HERBERT STEVENS, M.B.O.U.

Part III.

(With 3 plates.)

(Continued from page 740 of this volume.)

SUB-FAMILY—BRACHYPODINÆ.

**94. The White-throated Bulbul. *Criniger tephrogenys flaveolus* (Gould).**

Occurs at *low elevations* in the Tista Valley. Obtained up to 1,500' (G. E. Shaw). Nowhere does it reach the limit or anything approaching "seldom above 5,000'" as recorded by Oates. It is strictly a plains Bulbul.

**95. The Himalayan Black Bulbul. *Microscelis psaroides psaroides* (Vig.). "Kaki" Paharia.**

Dr. Hartert has stated the reason for this change in the generic name *Hypsipetes* now *Microscelis* (Nov. Zool., vol. xxix, 1922, pp. 366-7).

Numerous at *all elevations up to 10,000' on the Outer Ranges*. Tonglo summit at 10,000', 23-1-12\*, a party of from twenty to thirty birds came to rest in a tree adjacent to the Rest House; they were very wild and only settled for a brief time. Observed around Singhik at 4,850', 13-3-20\*, in a party of six or thereabouts.

**96. The Brown-eared Bulbul. *Hemixus flavala flavala* (Hodgs.).**

More or less locally distributed. Occurs in the Rungbong Valley up to 5,000'. Obtained in the Tista Valley up to 3,800' (G. E. Shaw).

**97. The Rufous-bellied Bulbul. *Hemixus maclellandi maclellandi*. (Hodgs.).**

Common from 3,400'-6,000' in the Rungbong Valley, and obtained in the Tista Valley from 3,900'-4,500'. (G. E. Shaw).

**98. The Striated Green Bulbul. *Alcurus striatus*. (Blyth).**

Locally distributed and fairly numerous both in the *Interior and on the Outer Ranges at elevations of from 4,700'-6,000'*. Obtained above Mangpu at 5,300'. (G. E. Shaw). Temi to Namchi at 6,100' 15-3-20\*, much in evidence. Occurs commonly at Gopaldhara from 4,700' upwards, being strictly confined to forest.

**99. The Bengal Red-vented Bulbul. *Molpastes hæmorrhous bengalensis* (Blyth).**

Commonly distributed at all elevations up to 4,500' at all events, but it is very doubtful if it approaches an elevation of 7,000' as recorded by Oates. This Bulbul and the next species consort together during the cold weather at the bottom of the Rungbong Valley and are then partial to the berries of the "Panisajh" trees.



**100. The White-cheeked Bulbul. *Molpastes leucogenys*. (Gray).**

"Jharali", Paharia, used for all Bulbuls without discrimination.

Commonly occurs from *low elevations at 1,200'* in the Tista Valley (G. E. Shaw), and probably lower, up to *6,000' on the Outer Ranges*, both in East Nepal and Sikkim. Observed around Shamdong at *2,600'*, in the interior of Sikkim during February and March.

**101. The Bengal Red-whiskered Bulbul. *Otocompsa emeria emeria* (L).**

In all probability does not occur much above Birik in the Tista Valley at *an elevation of 600'*, where I have observed this Bulbul. *Molpastes leucogenys* evidently takes its place on or about Tista Bridge and upwards.

**102. The Black-crested Yellow Bulbul. *Otocompsa flaviventris flaviventris* (Tick.).**

Widely distributed from *low levels up to 5,000'*. Obtained up to *3,000'* only in the Tista Valley. (G. E. Shaw).

**103. The White-tailed Nuthatch. *Sitta himalayensis* Jard. & Selby.**

Generally distributed at somewhat lower levels in the Interior of Sikkim than on the Outer Ranges. Locally migratory to some extent, descending the slopes of the mountains in the winter and ascending from the valleys with the advent of the hot weather. Observed below Gangtok at *3,100'* in early March. Singhik, *4,800'*, 24-2-20. Tonglo summit at *10,000'*, a pair seen on several occasions in January accompanying parties of Cole-Tits,—*L. rufonuchalis beavani* and *L. dichrous*. Mai "Khola," East Nepal, *8,500'*, 12-4-12, several seen this day. Tonglo, *9,000'*, 26-5-12, a pair, ♂ obtained; where they are also to be found during the S. W. monsoon. Gopaldhara, occasionally noted around the bungalow at *4,720'* at times during the "the rains" or "cold weather," never more than a pair of birds acting in concert with *Minla*, *Pseudominla*, &c., *5,800'*, ♂ ♀ 7-10-21. Obtained at elevations of from *5,500'-7,500'* above Mangpu. (G. E. Shaw.) Blanford met with it on the Cho La Range (August) at *11,000'* but met with no *Sitta* above *7,000'* in Northern Sikkim, which is also my experience in the winter.

**104. The Cinnamon-bellied Nuthatch. *Sitta castaneiventris castaneiventris* Blyth.**

Resident and generally distributed. Found at *all elevations up to 4,800'* around Gopaldhara, and obtained up to *3,800'* in the Tista Valley, below Mangpu. (G. E. Shaw.) *6,000'* as recorded by Jerdon and quoted by Oates is too great an extreme limit for Sikkim.

**105. The Beautiful Nuthatch. *Sitta formosa* (Blyth).**

The type locality is Darjiling and is thus recorded for Sikkim. Undoubtedly very rare and extremely locally distributed. I have failed to locate it. Evidently Macintosh was acquainted with it, as he quotes Senchal as being one of its haunts in his "Birds of Darjeeling." Represented in the Tring Museum by one specimen only *ex. Elwes Coll.*, but well represented in the National Collection by specimens obtained in almost every month of the year.

**106. The Velvet-fronted Blue Nuthatch. *Sitta frontalis frontalis* (Swainson).**

A Plains Nuthatch. Obtained in the Tista Valley up to an elevation of 2,500'. (G. E. Shaw). Nowhere approaches to an elevation of 5,000' or higher as recorded by Oates for the Himalayas, at all events in Sikkim. This Nuthatch is distinguished from true *Sitta* by several striking structural characters and is placed in the genus *Callisitta* by Hellmayr ("Genera Avium", Wytsman.) It well might find its correct place in this last genus if numerous other genera are retained.

**107. The Crow-billed Drongo. *Dicrurus annectens annectens* (Hodgs.).**

Recorded for the lower levels of Nepal and Sikkim.

**108. The Himalayan Black Drongo. *Dicrurus macocercus albirictus* (Hodgs.).**

Recorded for 5,000' or even higher in the Himalayas. I have no information respecting this Drongo. All my specimens of *Dicrurus* have proved to be the next species.

**109. The Himalayan Grey-Drongo. *Dicrurus leucophæus stevensi* Stuart Baker.**

Recorded for the Himalayas "found as high as 10,000' ". Generally distributed at moderate elevations to higher limits. The common Drongo in the Darjeeling District. Occurs around Gopaldhara at 5,000', as a breeding resident, also occurs plentifully in the Tista Valley at elevations of from 3,000'-3,750'. (G. E. Shaw), Thurbo, 4,500', 10-5-15\*. Four King Crows observed mobbing a pair of Owls (*Glaucidium cuculoides*).

**110. The White-bellied Drongo. *Dicrurus cærulescens* (L.).**

Recorded for the Himalayas up to about an elevation of 6,000'. I have no information respecting this Drongo. If it has any status in these hills, it is not likely to be overlooked, being a well-marked species. The series in the B. M. Coll. contains no specimen from the Sikkim Himalaya.

**111. The Bronzed Drongo. *Chaptia ænea ænea* (Vieill.).**

Generally distributed. Occurs up to 5,000' at all events in the Rungbong Valley. Not obtained above 3,000' in the Tista Valley. (G. E. Shaw).

Probably occurs much higher, though Gamnie found it breeding only at 2,000'.

**112. The Hair-crested Drongo. *Chibia hottentotta hottentotta* (L.).**

Sparingly distributed at the bottom of the Rungbong Valley from 3,500'-3,700', and when the "Falada" trees are in flower, comes up to the Bw. elevation of 4,720', 26-27-10-15\*, a pair, 11-9-20\*, a pair, 17-9-21\*, several in evidence, many even higher on occasions at 5,200', 1-2-21\*, noted hereabouts. As many as forty birds seen in the "simal" (*Bombax*) trees at Namsco at 3,000' on the 18-5-15\*. Obtained up to an elevation of 1,900' in the Tista Valley. (G. E. Shaw). Young birds ready to leave the nest by the end of June, or the first week in July; a specific date being the 25-6-23, when two youngsters were brought in at Gopaldhara.



**113. The Indian Lesser Racket-tailed Drongo. *Bhringa remifer tectirostris* Hodgs.**

Confined to the hot, moist, deep valleys. Observed around Dikchu at 2,150' in the interior of Sikkim, in February and March. 5,000' as recorded by Oates is too great an extreme limit in general for Sikkim, though Gamnie mentions it nesting at Rishap (Rashab) in the Tista Valley at 4,800'.

**114. The Assam Racket-tailed Drongo. *Dissemurus paradoxus grandis* (Gould).**

Extends up the Tista Valley to at least 1,000' (G. E. Shaw), but probably not far into the interior. Absent around Dikchu at 2,150', in February and March 1920.

**115. The Nepal Tree-Creeper. *Certhia familiaris nipalensis* Blyth.**

This Tree-Creeper is strictly sedentary, but on occasions descends to lower limits to some modified extent under stress of severe weather.

Recorded for 13,000', Pine forests, in September, North Sikkim. (Blanford).

Generally distributed from 8,000' to 12,000'. Observed below Sookia Pokhari at 6,500' ♂ ♀ 18-1-12.\* Occurs on Tonglo and Sandakphu summits throughout the winter, when it is then partial to the dwarf birch trees on the bare mountain slopes, generally in pairs, accompanying a foraging party of Cole-Tits: *Parus ater æmodius*, *P. rufonuchallis beavani* and *L.d. dichrous*. Tonglo, 9,000' to 10,074', summit level, a series of three ♂ ♂, five ♀ ♀, collected in January 1912.

Karponang at 11,000', in March 1917, only an occasional bird seen, and evidently far from common in the Pine forests during the winter.

Six specimens examined :

♂ Bill from feathers, at base 14; wing 68-69, av. 68·5.

♀ " " " " 11-12, av. 11·8; wing 65-66, av. 65·5.

Soft parts: Iris, brown; bill, black on upper mandible, white on lower mandible; tarsus, horny.

**116. The Sikkim Tree-Creeper. *Certhia discolor discolor* Blyth. "Soolsooli", Paharia.**

Commonly occurs in the *Rungbong Valley* from 3,500'-6,000' in the "cold weather," but seldom if ever observed in "the rains." Obtained in the Tista Valley around Mangpu at elevations of from 3,000'-4,500'. (G. E. Shaw). In the interior observed at *Shamdong* at 2,300', 15-3-20. Apparently does not overlap with *C. familiaris nipalensis* in its zonal distribution. Gopaldhara, 5,800', ♂ 5-2-21. 5,000', ♀ 16-2-18. 4,720', 16-7-21\*, a pair came into the compound in company with *Parus monticolus*, *Zosterops*, *Phylloscopus*, &c., 5800', a single bird observed in the forest 13-5-23, was most probably the pair to a breeding bird.

Eight specimens examined :

♂ Bill from feathers at base 14-15, av. 14·5; wing 67-70, av. 68·8.

♀ " " " " 12-13, " 12·4; " 64-67·5, " 66-2.

Soft parts: Iris brown; bill upper mandible dark horny, lower mandible pale horny, dark at tip, gape inside pale fleshy; tarsus dark fleshy-horny.

**117. Stoliczka's Tree-Creeper. *Certhia stoliczkae* Brooks.**

Fairly common from 9,000' to 10,000' on the *Singile La Ridge*, January to May; specimens secured both in Nepal and Sikkim. Obtained as low as 6,500', on the *Semana-Mirik Ridge*, ♀ 7-2-18. Ghoom to Sookia Pokhari, 7,100', 13-12-13,



*H. S. Photo.*

THE RIDGES OF EAST NEPAL.  
Looking west from Phalut, February, 1912.



*H. S. Photo.*

“THE SNOWS” AND PINE FORESTS.  
*Abies webbiana*, Silver Firs of Hooker.  
From Sandakphu, March, 1912.





several observed along the forest road. Tonglo, 10,000', ♂ 27-1-12. ♀ 28-1-12. ♂ 9-2-12. Kalo Pokhari, 10,160', ♂ ♀ 19-4-12, ♀ 21-3-12. ♂ 23-5-12. Observed around Lachung at 8,800' in February and March.

Five specimens examined :

♂ Bill from feathers at base 12 ; wing 74-76, av. 75.

♀ " " " " " 12 ; " 68-71, " 69.5.

Soft parts : Iris brown ; bill, upper mandible dark horny, lighter towards the tip, lower mandible pale horny, darkening towards the tip and edge in contact with upper mandible ; tarsus pale horny.

*Certhia himalayana himalayana* Vig., is stated by Dresser, Hartert, Stuart Baker and others to have an extensive distribution throughout the Himalayas—Kashmir to Kansu in Western China. Oates strictly confined this typical form to the N. W. Himalayas—Gilgit, Almora, &c. No trace of this Tree-Creeper occurring in the Sikkim Himalaya has come to my knowledge. It is not represented in the Tring Museum from Sikkim, and notwithstanding the fact that there is one specimen from Darjeeling collected by one of the Marshalls and also one specimen from Nepal.—*ex* Hodgson Coll. in the B. M. series, for which information I am indebted to Mr. N. B. Kinnear—there surely must be an error in the locality on the label of the Darjeeling ? skin. Col. C. H. T. Marshall refers to its breeding habits at Murree. (Hume's Nests and Eggs, Oates, Vol. I, page 220.) The Sikkim Himalaya holds three well-defined species with fairly distinct zonal distribution limits. It appears to have a discontinuous distribution in the Eastern Himalayas.

If my surmise is not correct, it is surprising such a paucity of specimens from this area exist in representative collections.

### 118. The Wall-Creeper. *Tichodroma muraria* (L.).

The Wall-Creeper may be found *during the winter at diverse altitudes* in suitable localities, though it is rare and of uncertain occurrence.

Obtained at Mangpu, 3,800', 21-11-19. (G. E. Shaw). Jalapahar, 7,500', ♀ 13-2-20. Sandakphu, Nepal side of the Frontier at 11,800', 7-3-12,\* a single bird observed this morning, foraging on the face of a huge boulder, rather wild and difficult of approach once it was aware of my presence. Hereabouts, these rocks seemed most suitable haunts for Wall-Creepers, yet this was the only occasion I met with it. Lachung, circum. 9,000', odd birds observed on the rocky slopes of the valley during February and March 1920. One observed in the stony bed of the La chu at 8,800', 10-3-10\*, had assumed the black throat associated with the adult in summer plumage. Three observed above Bhotan Ghat in the Raidak Gorge in January 1922, two of which were secured.

Three specimens examined :

♂ Bill from feathers at base 25 ; wing 109. ♂. Bill 24, damaged in the other example. Wing 102 in both cases. Compared with two females from the North frontier of Assam. Bill 25; wing 102-103. prove these measurements to be fairly constant. The spots on the outer primaries and tail vary in size and number individually in the adult, and the ochreous spot on the inner primaries is sometimes retained at maturity.

♀ (Assam). 2nd-5th primary, two spots, all white and large, 6th primary, one upper white spot. ♀ 2nd-4th, similar, 5th, merely an indication of the upper white spot, 6th, tinged ochreous, 7th, ochreous, 8th, merely an indication of an ochreous spot.

♂ (Bhotan Dooars). 2nd-5th, two spots all white and small, another ♀ from the same locality somewhat similar.

♀ (Darjeeling). 2nd-5th spots white, all lower ones small, upper spots large, 6th, upper spot only; ochreous lower half, remainder white. 7th-9th, single spots only, entirely ochreous.



**119. Hume's Wedge-billed Wren. *Sphenocichla humei* (Mand.).**

Recorded for Sikkim. Undoubtedly rare, with a restricted distribution. Specimens in the Tring Museum labelled Namchi, probably came from Tendong above this place.

**120. The Nepal Wren. *Troglodytes troglodytes nipalensis* Blyth.**

Resident on the *Singile La Ridge* at elevations of from 9,000'-12,000', numerous at this extreme limit in winter. In the interior of Sikkim at Lachung, occurs at an elevation of 8,800' in the valley during February and March. Karponang, 10,000' and above, on the slopes of the mountains during March. Once obtained amongst the rocks on Jalapahar at 7,500' ♂ 14-2-20, which is food for speculation as the Senchal to Darjeeling Ridge is quite isolated from the main bulk of the higher ranges, and it would mean a lengthy flight if such was the case, to avoid the valleys for a sedentary resident. It frequents the rocky beds of mountain streams, fallen decaying trees in the pine forests, equally at home amongst the snow in inhospitable depths of the forest or the precincts of the flimsy dwellings of the shepherds. In the village of Lachung, it was partial to the crevices of the stone walls which demarcated the plots of rudely cultivated land. Tonglo, 9,000'-10,000', 24th January to the 4th of February 1912, 3 ♂ ♂, 2 ♀ ♀ secured. Sandakphu to Saburkum 11,500', ♂ 16-2-12. Kalo Pokhari, 10,160' ♂ 4-3-12.

Karponang, 10,000', ♂ 17-3-17. Lachung, 8,800', ♀ 27-2-20, not observed in the winter beyond a three-mile limit above the village, along the path to Yumthang.

Eight specimens examined :

♂ Bill from feathers at base 10-11, av., 10·6 ; wing 51-53, av. 52·6.

♀ " " " " 10·5-11·5, av. 10·8 ; wing 50-53, av. 51·6.

The female average is brought up with the large dimensions of a Lachung specimen. Bill 11·5 ; wing, 53.

**121. The Spotted Wren. *Elachura formosa* (Walden).**

Recorded "high elevations in Sikkim." I anticipate this Wren will eventually be located along the foot-hills and probably in the bottoms of the valleys of the interior, at all events during the winter, with a similar habitat to *Pnaepyga pusilla*.

**122. The Tailed Wren. *Spelæornis caudata* (Blyth).**

Recorded for Sikkim at considerable altitudes. Obtained at Jore Pokhari, 7,400'. (C.M. Inglis). Represented in the B.M. Coll. by a fine series collected by Mandelli with nothing more definite in regard to the exact localities than "near Darjeeling."

**123. The Slaty-bellied Shortwing. *Tesia cyaniventer* Hodgs.**

Generally distributed in forested country with a sufficiency of undergrowth from the plains level up to 6,000', and apparently not resident around Gopaldhara at 4,700', as it has only been noticed hereabouts at the breeding season from the end of March or thereabouts and onwards.

Eleven specimens examined from the Eastern Himalayas.

♂ Bill from base 14-14·5, av. 14·3 ; wing 47·5-49, av. 48·9.

♀ " " " 13-13·5, av. 13·3 ; wing 44-48, av. 46·3.

One specimen, collected in the Plains of Upper Assam at Rungagora in the Dibrugarh District, ♂ 10-1-04, has the crown concolorous with the back and the whole of the underparts from the chin to the vent pale slaty-blue. This phase ? has always puzzled me, as I do not consider it referable to the male juvenile stage of this species; the bill, tarsus and hind claw are stronger than in any of the other previously measured specimens.

Bill from base 16; wing 49; tarsus 25; hind claw 7.

It is very near to *Tesia cyaniventris superciliaris*, La Touche, after comparison with the type.

"Very close to the female of typical *T. cyaniventris*, but with a much more pronounced and purer black eye-stripe and lores, and with a short, pure grey stripe just behind the eye, between the yellowish supercilium and the black eye-stripe. A bird from Manipur in the British Museum Collection is very similar, but lacks the post-orbital grey stripe and is paler below."

*Ibis* July 1923, pp. 369, 370. "On the Birds of South-East Yunnan, S. W. China." (S. D. La Touche, M. B. O. U.)

♂ Soft parts: (June.) Iris brown; bill upper mandible blackish-horny, lower mandible and inside gape, reddish-orange; tarsus, dark olivaceous; claws horny.

#### 124. The Chestnut-headed Shortwing. *Tesia castaneocoronata castaneocoronata* (Burton).

This Shortwing seems to me to be entitled to generic rank, but as Dr. Hartert has shown, (*Novitates Zoologicae*, Vol. XVII, 1920, page 480) *Oligura* cannot stand. Apart from coloration which may have no significance in the definition of genera; the remarkable bill of *Tesia cyaniventer* appears to be a sound structural character for generic distinction and congeneric with this species is *Pseudoxenicus superciliaris* (Bp.). Type Locality, Java, whereas *Tesia castaneocoronata* has a totally different, slender and narrow bill; which was one of the reasons given by Oates for keeping them generically separated. It is found at all elevations from the foot of the hills in "the cold weather," up to 10,000' or higher in summer. Blanford records it from Northern Sikkim at elevations of from 7,000'-10,000'. Observed on the Singile La Ridge at Kalo Pokhari at 10,160', in May. Mai ("Khola") Valley, East Nepal, 8,000' upwards, ♂ 9-4-12, ♂ 7-5-12. Bhotan Ghat, Raidak River, Eastern Dooars, ♀ ♀ 22-24-1-22, others seen. Gopaldhara, Rungbong Valley, 3,550'. 22-3-11\*, noted on several occasions afterwards, more in evidence than *T. cyaniventer*. It is more addicted to frequenting the ground than its former ally and hops about the rocks in like manner to a wren. 4,700', ♂ 29-10-16, 7-4-16\* 4,800', ♀ 1-11-18. 5,000', ♀ 17-2-18. 5,900', ♂ 17-2-18. Mangpu, 3,800', 26-3-15\*, in scrub-growth. Rashab, Tista Valley, 4,500', 15-3-20\*, in bamboo forest.

Eight specimens examined and compared with four Assam skins:

♂ Bill from feathers at base 9.5-10, av. 9.6; wing 47.5-50, av. 48.4.

♀ " " " " " 10, av. 10; wing 46-48.5, av. 47.7.

These females show a tendency to have a slightly stronger bill, which is the reverse case in my specimens of *Tesia cyaniventer*.

#### 125. The Scaly breasted Wren. *Pnœpyga squamata* (Gould).

Blanford records it from northern Sikkim at 9,000'. It occurs in limited numbers from 5,000'-10,000' on the Outer Ranges according to season. Obtained in the Tista Valley at 3,000'-5,900', (G.E. Shaw). Resembles a small rodent as it searches the ground in quest of food, most fearless, as on occasions it may come up to one's feet; neither is it easily dislodged from the crevices in which it takes shelter when approached, in this respect is similar to *Troglodytes nipalensis*.



Six specimens examined:

♂ Bill from feathers at base 10.11, av. 10.8; wing 58.63, av. 61.5.

♀ " " " " " 10.11, av. 10.5; wing 59.5-62, av. 60.8.

The tertiaries in five adults are tipped with fulvous as in *P. pusilla*, a character of no consequence in discriminating between the two species; the difference in size being, however, quite sufficient for this purpose.

## 126. The Brown Wren. *Pnæpyga pusilla* Hodgs.

Sparingly distributed from the base of the hills up to an elevation of 6,500' or thereabouts; there is an overlapping to some extent in the breeding range of both this wren and its near ally. Obtained on the Semana-Mirik Ridge at 6,250', 18-2-18, and also on Tonglo (C. M. Inglis) at 10,000', most likely a straggler, Gopaldhara, 4,700', 28-2-21\*. 5,500', ♂ 14-4-21. Bhotan Ghat, Raidak River. Eastern Dooars, ♀ 20-1-22. Obtained at Mangpu at 3,600', (G. E. Shaw).

Two specimens examined: ♂ Bill from feathers at base 11; wing 53.

♀ " " " " " 9.5; wing 49.

In these two adults, "correctly" sexed, ♂ testes in advanced development; the usual distinguishing character in colour between the two sexes is reversed: the whole of the lower plumage in the male being fulvous, while the female is in the pale phase, which is regarded as the normal coloration of the male. All specimens, if sexed with absolute certainty, will eventually help to solve this interesting problem.

## 127. The Himalayan Goldcrest. *Regulus regulus himalayensis* Jerd.

Sparingly distributed on the Singile La Ridge during the winter at 10,000'. In the interior of Sikkim occurs at this period of the year at 9,000' in the bed of the valleys, and though by no means numerous, is apt to be overlooked, or its identity mistaken if intermingled with *Phylloscopi*. Tonglo, 10,000', Nepal side of the Frontier, ♂ ♂ ♀, 25-1-12, the only occasion on which the Goldcrest was observed, these three birds were keeping up a lively commotion during a bright afternoon amongst the flowers of a stunted tree (*Daphne cannabina*). Lachung, 9,500'. ♂ ♂ ♀, 7-3-20. secured out of a party of eight to ten individuals accompanied with Cole-tits: *Parus ater æmodius* and *P. rufonuchalis beavani*, in light mixed tree-growth, Larch predominating, below the main belt of the Pine forests.

Five specimens examined:

♂ Bill from feathers at base 7.7.5, av. 7.3; wing 56.58, av. 57.

♀ " " " " " 7, av. 7; wing 54.55, av. 54.5.

Soft parts: Iris brown; bill black; tarsus brownish-ochreous; toes and claws paler ochreous.

## 128. The Fire-cap. *Cephalopyrus flammiceps* (Burton).

Evidently locally distributed and by no means numerous, if indeed not actually rare. Obtained on four occasions in the Tista Valley at elevations of from 3,400'-3,700', 16-23-2-19, 3,850', 23-2-18. (G. E. Shaw).

Rungpo, Tista Valley, 1,250', 19-2-20\*. A party of twelve to fifteen counted at rest on the naked branches of a shade! tree near the road-side on the Sankokhola road. On their taking flight they were more like Munias or Finches. I observed them very carefully at close quarters under a powerful glass and could hardly have made any mistake. So far I have failed to meet with it around Gopaldhara, and it may only be confined to moderate elevations in the Tista Valley. It is represented from Sikkim in the B. M. Coll. by 3 ♂ ♂, February and March.

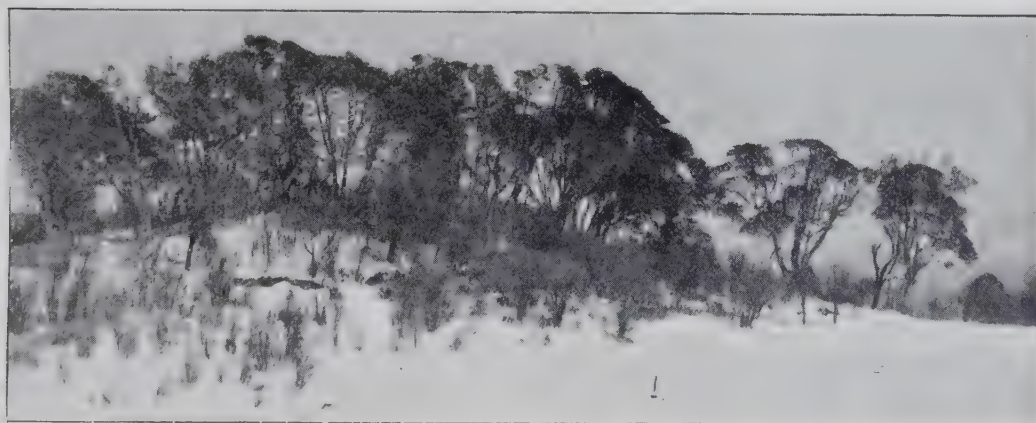
*Acrocephalus agricola* sub-sp. nov.

*Acrocephalus stentorea* sub-sp. nov.



H. S. Photo.

VALLEY IN NEPAL, below Phalut. February, 1912.



H. S. Photo.

TONGLO, near the summit level of 10,074'. January, 1912.

Haunts of *Urocissa flavirostris*, *Nucifraga hemispila*, *Trochalopteron affinis*,  
*Ixops nipalensis*, *Yuhina gularis*, *Fulvetta vinipecta*, *Phænicurus schisticeps*,  
*P. frontalis*, *Perissospiza icteroides affinis*, *Pyrrhula erythrocephala*,  
*Carpodacus rhodochroa*, *Callacanthus burtoni*, &c., &c.



H. S. Photo.

MAI ("KHOLA") VALLEY, East Nepal, from Kalo Pokhari.  
 Rhododendrons in bloom. April, 1912.





In my "Notes on the Birds of Upper Assam," B. N. H. S. Vol. XXIII, page 247, I recorded the first mentioned Reed-Warbler under the typical form. The winter migrants to Assam have been considered to be the eastern race "*concinens*" (Swinh.). In recent years a breeding bird has been described from (1920-Kaghan) North-west India, i.e., "*haringtoni*" Witherby.

I have made a further examination of my Assam skins and eggs, which has resulted in an interesting discovery that there are two races of *Acrocephalus* breeding on the "churs" of the Subansiri River in Upper Assam; the larger bird is a race of "*stentorea*" and the smaller bird is a race of "*agricola*." Specimens obtained in January at Gogaldhubie, ♂ 10-1-05, wing, 60. Boduti, ♂ 13-1-11, wing, 57.5. In both specimens 1st primary, 12, "narrow." These birds are paler on the underside compared with specimens from Hessamara obtained in April which have a decided rufous tinge on the underside, ♂ 11-4-15, wing, 53, ♂ 9-4-05, wing, 49.5. 1st primary, 11-12.5 "wider" than in the two former specimens; these latter can only be breeding birds, the difference in the wing formula is significant. I expressed my surprise when, having noted this Reed-Warbler as particularly numerous in April, I failed to meet with it in December of the same year. This is not remarkable but at the time was not rightly understood as the birds were evidently absent from their breeding haunts in the winter. Undoubted *Acrocephalus* eggs have been laid aside during my long residence in the east and it is only recently that I have been able to verify my contention that breeding birds of two races of *Acrocephalus* did exist in the Plains of Upper Assam. Whilst my skins are deficient in number; seven clutches of eggs have been examined.

Dr. Hartert gives the wing measurement of "*concinens*," as somewhat shorter than typical "*agricola*" which is stated ♂ ♀ 55-60.5, "*haringtoni*" ♂ 56-58, ♀ 54-58.

The habits of *A. agricola* are said to be "very aquatic." I only found this to be the case with the bird obtained in the "cold weather."

Contradictory data in respect to the habitat of this species and also *A. dumentorum* which also occurred during the winter puzzled me considerably. I found *A. stentorea* a terrible skulker but at the nesting time the birds might almost be said to breed in colonies as all my eggs came from a limited area.

My cold-weather migrants have the 2nd primary between the 6th and the 7th, which is the wing formula for typical *A. agricola*, whereas the 2nd is equal to the 10th in the breeding bird and in this character is nearest to *A. concinens*. Mr. F. C. Stuart Baker has described this race as *stevensi*†, and after comparing 60 eggs of *A. s. brunnescens*, av.,  $22.7 \times 15.9$ , with the eggs of the "dark" breeding race of *stentorea* in Assam, which are darker, more brown and less green, 20 eggs average  $19.6 \times 15$ , has named this race *amyæ*, wing, 83, in honour of my wife. The type specimens of these two new *Acrocephali* have been presented to the British Museum.§

Soft parts in "*agricola agricola*," (January): Iris olive-brown; bill upper mandible and tip of lower mandible blackish-horny, remainder horny-white; tarsus brownish-horny. "*agricola stevensi*," (April): Iris olive-brown; bill upper mandible blackish-horny, commissure line pale, lower mandible horny, darker towards tip; tarsus, brownish-horny.

## 129. The Turkestan Grasshopper-Warbler. *Locustella nævia straminea* (Severtz.).

Recorded for Native Sikkim: a specimen having been procured in June which is an immature bird collected in 1876 and represents the Sikkim material in the National Collection.

† Represented in the B. M. Coll. by other specimens from the Bramaputra "churs" collected by Godwin-Austen.

§ Descriptions in the Bulletin B.O.C. Vol. XLIII, No. CCLXXI, pp. 16 & 17.



**130. The Spotted Bush-Warbler. *Tribura thoracica* (Blyth).**

Mandelli is mentioned in Hume's "Nests and Eggs" as having obtained it on three occasions, breeding in July at Yendong ? (Tendong) and Gammie on one occasion near Rungbee in June at 5,000', a specimen in the B. M. Coll., is dated 15-6-75, female snared on the nest and probably refers to this record. There are other six specimens collected in every month from February to June and one in November and also a single specimen from the Bhotan Dooars, February, 1876, all of which are Mandelli's skins. This material has furnished Oates with its status as a nesting species and occurring up to 9,000'. It has in recent years been obtained on Phalut in the summer. (C. M. Inglis).

**131. The Brown Bush-Warbler. *Tribura luteoventris* (Hodgs.)**

Recorded under *Tribura mandellii* for Sikkim (February to May). Represented in the B. M. Coll. by Hodgson's specimens from Nepal and Mandelli's specimens from the Bhotan Dooars and Native Sikkim, from which last area there is one, dated June 1874. Mr. C. M. Inglis has obtained it on Phalut in the summer and this was apparently the species I saw at Lachung at 9,000' on the 28-2-20\*, unfortunately none were secured out of the small party, of which an odd bird or two were noted on this single occasion, as they were on the move in and about some scanty vegetation, and could have hardly been *Suyas* at this elevation in the winter, although they appeared to be a sedentary species to the valley.

**132. The Indian Tailor-bird. *Orthotomus sutorius sutorius* (Forst.).**

At the foot of the hills, this Tailor-bird frequents light, open forest, but does not penetrate the forest depths. Resident up to 4,720' in the Rungbong Valley, an odd pair or so frequent the compound of the Gopaldhara Bw. and may be seen either in winter or summer. Obtained around Mangpu at 3,600', (G. E. Shaw) above the Tista Valley, where formerly Gammie obtained it. Gangtok at 5,800' and lower, 21-2-20\*, it was much in evidence to judge by its high-pitched note, yet not actually observed in the dense scrub-growth which it was frequenting. Gopaldhara, 4,500', 28-5-23. Three fully fledged youngsters almost ready to leave the nest.

**133. The Black-necked Tailor-bird. *Orthotomus atrogularis* (Temm.)**

Its distribution is stated as Lower Ranges of the Himalayas from the Rangit River in Sikkim to the Dhansiri Valley, Assam. It is somewhat remarkable that all the specimens I have procured at the base of these hills have all been *O. sutorius* and I have singularly failed to meet with it anywhere along the foot-hills of the Eastern Himalayas. The only locality in Upper Assam where it occurred was above Margherita to the east, and Mr. E. C. Stuart Baker informs me it had a habitat distinct from *O. sutorius* being confined to the forest and not found in the open surroundings.

As I could only find the Dhansiri Valley specimen in the B. M. Collection, I requested Mr. N. B. Kinnear for information and he reports that this species is not represented from west of Assam. In view of this fact it certainly seems as if the recorded distribution will have to be altered and this Himalayan portion of its range eliminated, notwithstanding Mandelli is said to have obtained its nest and eggs near the Great Rangit River.

134. Franklin's Wren-Warbler. *Franklinia gracilis*  
(Frankl.).

Recorded as "ascending the Himalayas to considerable elevations, and specimens as having been collected at Darjiling and in Native Sikkim." I have no record of this Wren-Warbler in these hills, which commonly occurs at plains-levels. Mr. G. E. Shaw has obtained a *Franklinia* in the Tista Valley at elevations of from 2,000'-4,000' which he puts down as *F. rufescens* and I observed at Gitingy, 1,100'. 12-2-14\*, a party of eight to ten birds on the maidan above the Mahanuddi, which I considered were also this same species. I doubt very much if this bird or any other member of this genus ever "abandons its accustomed haunts on the approach of winter" as these birds are strictly sedentary. It is more likely that all the specimens that Oates went through, came from the valleys in Sikkim.

This remark has no reference to its distribution in the North-West Himalayas. This genus appears to be in an unsatisfactory state, both in regard to the characters, habitat and distribution of each species. My notes can only serve to draw attention to the difficulties with a view to the ultimate clearing up of several knotty points which seem to me obscure.

In the Bhotan Dooars, January 1922, there occurred two species of *Franklinia* in small parties occupying distinct habitats. The bird I regard as *F. gracilis* was only to be found in the more open country, frequenting scrub-growth in the dried-up beds of the river channels, outside of the heavy forest, about two miles south of Bhotan Ghat on the Raidak River, 29-1-22, ♂ Bill from base 14 wing 46. 29-1-22, ♀ Bill from base 13·5; wing 44.

Soft parts: Iris ochreous-brown; bill blackish-horny; tarsus ochreous fleshly; claws, pale horny-black.

Coloration.—Upper surface dark rufous, the tail tipped with white; which character appears to be constant in this species, yet the bills in both these two specimens are stronger than any of the following birds from Assam which have been measured for comparison.

Upper Assam, Dibrugarh District, Margherita. (Base of the hills to the east). 23-11-03, ♀ Bill from base, 12; wing, 44. In coloration agrees with the two former specimens.

Rungagora, (Plains), 6-4-03, ♀ Bill from base 12; wing 42.

Rungagora, (Plains), 13-4-03, ♀ " " " 11·5; wing 43.

North Lakhimpur, Derpai, (Base of the hills to the west), 21-3-05, ♀ Bill from base 12; wing 42.

Coloration.—Upper surface a drab ashy, which is evidently the normal breeding plumage.

Dejoo, 15-6-04, ♂ Bill from base 12; wing 48·5.

Dejoo, 3-7-04, ♂ " " " 12·5; wing 48.

Dejoo, 16-7-04, ♂ " " " 12·5; wing 48.

Dejoo, 4-8-04, ♀ " " " 12; wing 45.

Coloration.—These four specimens are in worn breeding garb and show the well-defined ashy band on the breast.

Dejoo, 22-6-04, ♂ Juvenile, Bill from base 11; wing 43.

Dejoo, 12-8-04, ♀ " " " " 11·5; wing 44.

No use for comparison, being young birds which have not long left the nest.

Coloration.—Pale ashy-rufous on the upper surface, below, white on the throat to breast, pale rufous on the belly; "tips to tail white."

Dibrugarh District, Rungagora, 16-1-03, ♀, Bill from base 12; wing 42.

Rungagora, 16-1-03, ♀, Bill from base, 12; wing, 41.

North Lakhimpur, Dejoo, 28-11-10, ♀, Bill from base 12; wing 44.

Soft parts: Iris dark ochreous-yellow or dark straw-yellow.



Coloration.—These last three specimens have the upper surface tinged with rufous and to a less extent on the flanks; the tips to the tail are white. There is no dark head as is said to be present in *F. rufescens*, and though the tarsi are darker; the bills are not a defined black, as is said to be the case with *F. gracilis*. All the same I consider them to be in a stage of plumage which appears to be referable to this species.

**135. Beavan's Wren-Warbler. *Franklinia rufescens* (Blyth).**

Bhotan Ghat, Raidak River, Eastern Dooars, 26-1-22, ♂ ♂ Bill from base 13.5-14; wing 45-45.5. Obtained out of a small party in light undergrowth inside the fringe of the heavy forest at the base of the hills.

Soft parts: Iris pale brown; bill horny-black, edge of the lower mandible pale; tarsus fleshy-white; claws horny.

These specimens appear to be referable to *F. rufescens*. The crown is slightly darker than the back in one example, but with the exception of the fulvous tips to the tail approach in their bright rufous coloration the last three specimens of *F. gracilis*. Oates makes this species to have a smaller wing and a larger bill than *F. gracilis*. There is no appreciable difference in any of these characters as compared to the birds recorded under *F. gracilis* obtained three days later in a different habitat; apart from the head, the rest of the plumage shows a marked resemblance to *F. cinereocapilla*. Apparently *F. rufescens* is more of a hill-species, and appears to have a restricted range along the base of the hills, and *F. gracilis* while extending right up to the foot of the hills and possibly in the valleys shuns the well-wooded tracts. The exact distribution of the two species from correctly identified specimens is desirable.

**136. Hodgson's Wren-Warbler. *Franklinia cinereocapilla* (Hodgs.)**

This Wren-Warbler occurs sparingly at the bottom of the Rungbong Valley and below Gopaldhara at an elevation of from 3,500'-4,500'. One secured on the 20-12-11, and a pair observed at 3,550' on the 4-7-16\* in a thicket of reeds.

Blanford noted this species from Sikkim, yet Oates regarded his description as agreeing with *F. rufescens*. In my single specimen, I can detect no band behind the eye dark bluish-ashy, which colour is confined to the crown and nape, while the forehead is rufous, the supercilium is pale fulvous: broad in front of the eye, narrowing posteriorly over the ear-coverts which are dark fulvous; immediately in front of the eye is a dark spot on the lores. A minute description is very essential in the differentiation of the characters of the head in these *Franklinias*. The seasonal changes are difficult to follow, as the colour differences do not lend to easy description.

**137. The Thick-billed Warbler. *Phragmaticola ædon* (Pall.)**

Recorded for Sikkim, both British and Native. With the exception of two observations which are doubtful as no specimens were secured I have nothing on record respecting this Warbler which I knew as a cold weather visitor to the Plains of Upper Assam. Gopaldhara, 4,720', 28-9-16\*, a bird came to my Kitson moth lamp at night which seemed to be this species. Turzum, 4,800' 18-1-12,\* seen in "the tea" yet not near enough for a certain identification. Represented in the B. M. Coll. by three September and October specimens collected in 1876.

**138. Tickell's Willow-Warbler. *Phylloscopus affinis* (Tick.).**

Recorded "breeds high elevations in the Himalayas."

Only occurs sparingly on migration at moderate elevations. My observations have been extremely limited in regard to this Willow-Warbler.

Gopaldhara, 4,720', 9-4-17', one obtained. Chungthang to Toong at 4,500', approx. elevation, 12-3-20\*, a few noted in the valley at one locality only. Blanford met with it in the Lachen and Lachung Valleys at 8,000'-9,000', but none before the 26th September. Recorded up to 15,200' in Tibet. (Walton).

**139. The Smoky Willow-Warbler. *Phylloscopus fuliginiventer* (Hodgs.).**

Recorded for Sikkim "14,000', Blanford," and merely noted in the months of "February to June, Mandelli." I have failed to meet with this Willow-Warbler, which commonly occurred during "the cold weather" in the Plains of Upper Assam. Oates states this species to be resident and is evidently quoting Blanford in reference to the specimen obtained on Momay Samdong in rhododendron scrub.

**140. The Dusky Willow-Warbler. *Phylloscopus fuscatus fuscatus* Blyth.**

Recorded distribution "Found in Nepal"; probably in summer, and in Sikkim certainly at that season if we identify with this species the bird of which Jerdon found the nest at Darjiling in July. Hodgson's *Horornis fulviventer* is undoubtedly this species as proved by his types (No. 878) in the British Museum, and Jerdon identified his Darjiling specimen with *H. fulviventer*. It seems unaccountable that I have totally failed to locate a single specimen of this Willow-Warbler in these hills. I found it just as common in the Plains of the Eastern Dooars in "the cold weather," 1922, as it was at the same time of the year in the Plains of Upper Assam. They evidently either enter the plains to the east, or pass over the outlying hills during migration.

An examination of my material is detailed.

*Upper Assam.* (Plains).

Dibrugarh District.—

Rungagora.

♂ 25-1-03, wing 61·5; tail 46; 1st primary 20, (Dibru River), "very aquatic" noted on label.

♂ 15-10-03, wing 63; tail 45·5; 1st primary 20·5.

♂ 28-2-04, " 59; " 47; " " 21·5.

♂ no date, " 63; " 46; " " 22.

North Lakhimpur. Hessamara.

♂ 4-1-06, wing 63; tail 48; 1st primary 21.

Derpai.

♂ 14-3-06, wing 60; tail 48; 1st primary 21.

Dejoo.

♂ 15-3-10, " 61; " 48; " " 19·5.

Dibrugarh District—

Rungagora.

♀ 27-4-03, wing 59; tail 46; 1st primary 18

♀ 3-5-03, " 58; " 45; " " 18.

♀ 4-5-03, " 56·5; " 44; " " 18.

♀ 4-5-03, " 56·5; " —; " " 18.

Dejoo.

♀ 28-9-10, wing 56, tail 44; 1st primary 18.

*Eastern Bengal.* (Plains.)

Jalpaiguri District.—

Kumargram.

♂ 9-1-22, wing 63·5; tail 50; 1st primary 19.

♀ 9-1-22, " 57; " 45; " " 19.



These two latter specimens are more "dusky-olivaceous" than skins from Upper Assam with a "russet-olivaceous" tinge over the whole of the upper surface. Dr. Hartert gives the measurements of "*fuscata*": ♂ wing 60-66; ♀ 53-58, ♂ tail 53-58, ♀ 48-50; tarsus 20-22; culmen 12-13.5.

There appears to be more than one species amongst the above noted cold-season? specimens, though it is impossible to discriminate. I could never understand why this bird should remain in the plains of Upper Assam into May. I have recorded *fuscata homeyeri* (Dyb.) up to as late as the 22nd of May. It is well known that the birds of this humid climate have the tendency to exhibit a dark phase of plumage, and I shrewdly suspect a breeding Warbler will eventually turn up in the Plains. Against this conjecture is the fact that birds which have to accomplish a long journey to the far north invariably are late starters.

What was Oates's reason for stating "*fuliginiventris*" to be a resident species? a somewhat similarly coloured bird to "*homeyeri*," both of which occurred in a similar habitat in Upper Assam. It is to be presumed, he had seen specimens from the plains at even later dates than what I have recorded, unless his remark has no connection with the birds obtained in "the cold weather" at low elevations and only refers to Blanford's single specimen from 14,000', which would still be a contradiction.

#### 141. The Grey-faced Willow-Warbler. *Phylloscopus maculipennis* (Blyth.).

Obtained on the Outer Ranges at Gopaldhara at as low an elevation of 3,700' 27-2-19, up to an altitude of 10,160', at Kalo Pokhari, 28-4-12. In the interior obtained at an elevation of 4,600', around Singhik, 23-2-20, and around Lachung, at 8,900', in the first week of March 1920, at which time it ranged the highest of all the Willow-Warblers. Commonly occurs around Gopaldhara at 4,700' and upwards, during December and January. Obtained on the Ghoom to Sookia Pokhari Ridge at 7,000', 19-1-12. On Jalapahar at 7,500', 14-2-20. Numerous in the station of Darjeeling during January and February. A series collected in the Mai "Khola" in East Nepal at 9,000' and below, during April 1912.

Thirteen specimens examined :

♂ Wing 48-51, av., 50. ♀ 45-48, av., 46.8.

#### 142. The Orange-barred Willow-Warbler. *Phylloscopus pulcher* Blyth.

Recorded as a "resident where found and procured up to 13,000', Cho La Range (Blanford), in Sikkim." Obtained as low as 3,900' at Thurbo on the 2-4-11, and at 4,720', at Gopaldhara, 8-3-21 in the Rungbong Valley. The former record is evidently a late straggler, as a few birds were also obtained at 10,160' around Kalo Pokhari on the 12-4-12; but it was more numerous in the Mai "Khola" in East Nepal at lower elevations, 7,000'-10,000', March and April 1912. Plentiful around Gopaldhara at 4,720', November to February. *It can by no means be regarded as a resident as it performs an altitudinal movement.*

Fourteen specimens examined :

♂ Wing 54-61, av. 57.4. ♀ 55-58, av. 56.

#### 143. Pallas's Himalayan Willow-Warbler. *Phylloscopus proregulus newtoni* (Gätke).

Occurs commonly around Gopaldhara from 3,500', 30-1-19, up to 5,800', 5-4-21. Obtained at all intermediate elevations, December to March, also obtained at the foot of the hills at Bhotan Ghat, Raidak River, Eastern Dooars, in January

1922. Mangpu at elevations of from 3,500'-4,000', (G. E. Shaw). This Willow-Warbler is *confined to moderate elevations only as a breeding species*. Blanford records obtaining two specimens in Upper Sikkim at the end of September and the beginning of October.

Ten specimens examined: ♂ Wing 50-53, av. 51.7; ♀ 46-50, av. 48; one ♀ 5-4-21, actually has a wing of 55; this abnormal specimen has not been included. (Assam) skins for comparison. Seven examined: average, ♂ wing 54; ♀ 50.5.

Soft parts: Iris hazel-brown; bill, upper mandible dusky, lower mandible ochreous, dark at tip; tarsus dusky-ochreous; soles ochreous.

**144. The Crowned Willow-Warbler. *Phylloscopus inornatus inornatus* (Blyth).**

A series of four ♂♂, ♀♀ collected at Bhotan Ghat on the Raidak River Eastern Dooars, at the foot of the hills, 20-26-1-22.

Nurbong, below Tindharia at 2,240', ♂ 22-2-14. Turbo, 3,900', ♂ 2-4-11. 4,300', ♀ 23-25-3-11. Gopaldhara, 3,700', ♀ 27-2-18. 4,000', ♀ 7-2-19. 4,720', 3 ♀♀ 19-23-12-11, ♀ 14-12-19, ♀ 9-3-18, ♂♂ 22-3-16. 4,650', ♂ 8-2-19. 4,720', ♀ 9-3-18, give the zonal distribution of this Willow-Warbler during January, February and March; some of the late records in March and April refer to stragglers in partial moult, exhibiting a drab phase of plumage. This Warbler is absent around Gopaldhara during "the rains" and probably retires to breed in the vast regions north, as I have failed to meet with it at higher altitudes. Obtained around Mangpu at elevations of from 3,500'-4,000'. (G.E. Shaw).

Eighteen specimens examined: ♂ wing, 56-60, av., 57.7; ♀ 51-57, av., 54.

The 1st primary varies in length and breadth measuring in 8 ♂♂, 11-15, av. 13.5, and in 11 ♀♀, 10-14.5, av. 11.8. There is also some individual variation in the depth of tone in coloration which seasonal change does not seem to account for; also it may be remarked on the wing-bar across the greater coverts, the spots sometimes show as well-defined and deeper coloured blobs, seeming to indicate a sign of immaturity, as the lengthening of the inner feathers in growth causes this bar to assume a more oblique position. It is similarly the case with other members of the genus.

Soft parts: Iris hazel; bill, upper mandible and tip of lower mandible dusky-yellow (dark olivaceous), deeper in yellow tone at base of lower mandible (pale olivaceous); tarsus and claws dark olivaceous (brownish-olivaceous); soles yellowish.

*This Willow-Warbler is not recorded for Sikkim.* My specimens are certainly this typical form. Until the type specimen of *P. inornatus mandellii* (Brooks.) has been compared and its correct status confirmed, it is quite impossible to define its distribution, even though it is recorded for Sikkim and the Khasi Hills. Judging from the original description; the "buff" supercilium seems to be the only reliable character for differentiation. Brooks infers it is likely to be resident. The clearing up of this matter which at present is very obscure, is most desirable.

In working out several difficult groups of Warblers, Chats, &c., I have had the advantage of Mr. Arthur Goodson's experience and knowledge.

**145. The Greenish Willow-Warbler. *Phylloscopus nitidus viridanus* Blyth.**

Recorded as distributed throughout the whole length of the Himalayas—Hazara country to Sikkim. I have no personal information of its status in these hills, having totally failed to locate it. Mr. G. E. Shaw has also failed with this species and the two following species.



One ♂ from Kumargram in the Plains of the Jalpaiguri District, Eastern Bengal, collected on the 9-1-22 in open-cultivated country, is referable to this Willow-Warbler. This specimen is "in moult"! Bill from feathers at base, 9; wing, 61.

Unfortunately this race is poorly represented in the B. M. Coll. from the Eastern Himalayas, and Sikkim appears to be east of its main distribution area; there is one specimen collected by Mandelli in May 1876 and one specimen labelled, Darjeeling, 15-1-79, *ex. Coll.* E. W. Oates, probably one of Mandelli's skins, also one specimen *ex. Hume Coll.*, Nepal, no data, and one specimen, Nepal Valley, 23-4-77, collected by Scully. Osmaston has recorded this bird breeding in Sikkim, *Ibis*, Vol. XIV, page 816.

**146. The Large-billed Willow-Warbler. *Phylloscopus magnirostris* Blyth.**

Recorded in summer "Himalayas:—Kashmir to Sikkim." I have no record of this Warbler in these hills; it must be of rare occurrence, and it is remarkable that "*Acanthopneuste*" should only be represented around Gopaldhara by "*trochiloides*." As the wing measurement overlaps in this species with "*lugubris*" correctly sexed specimens are essential, despite the different wing formula:—2nd primary between the 7th and 8th or between the 6th and 7th, taken in connection with the stronger bill ought to be sufficient for identification. Wing, ♂ ♀ 62-72. (Hartert.) Mandelli's specimens in the B. M. Collection are few, but there is an undoubted specimen collected in August 1880, which might, however, have been obtained in the higher regions beyond the actual boundaries of Sikkim.

**147. The Dull Green Willow-Warbler. *Phylloscopus lugubris* (Blyth).**

Blanford found this Warbler at 12,000'-14,000' on the Cho La Range and a 10,000'-13,000' or 14,000' in the Lachung Valley in the autumn.

As there are *two races or even species occurring in the Eastern Himalayas*, I have gone into some detail with a view to elucidating further evidence as to their identity and status. Singile La Ridge, Nepal-Sikkim Frontier, Kalo Pokhari, 10,160', 21-4-12. This morning I came across a small party of these birds on arrival at their breeding haunts; they had ascended from the valley below on the Sikkim side of the frontier. It is necessary to mention this fact, as this valley is densely wooded, and if these birds had not been wintering in the bottom of the valley, they must have entered the hills by way of the Tista and Great Rangit Valleys, as the stream which had its rise in the "pokhari" runs into the Lodhoma River, which again is a tributary of the Rammam River; all these waters flow into the Great Rangit River and find their outlet to the plains by the deep gorge of the Tista. I have never come across this Warbler wintering in the valleys or at moderate elevations, and it is somewhat curious such an apparent, roundabout route should be chosen when the Mai Valley offered free access from the south, except perhaps for a deficiency of forest at its upper limits where the land has been partially cleared; this might have been a deterrent to an easy ascent as these birds had certainly worked up with the forest. The most feasible explanation appears to be one more instance of penetration into these hills, but in this instance, that of a migratory species by a route which is well marked. All specimens obtained on this occasion were males, and it is evident this sex arrives ahead of the female; two other ♂ ♂ were obtained on the 27-4-12 at elevations of 9,000' and 10,000' respectively, making a total of five secured. I never met with it anywhere else along this ridge. The first and only female secured, being snared on the nest on the 22-5-12. Nest composed of moss and fine bents lined with a few feathers and the hair of some small

rodent, probably *Microtus sikkimensis*? common hereabouts. It contained three pure white eggs measuring  $16.2 \times 12.6$ ,  $16 \times 12.7$ ,  $15.5 \times 12.4$  mm.

SERIES A.

Six specimens examined:

10,160', ♂ 21.4.12. Bill from base 13, from feathers 9; wing 64; tail 49; 1st primary, 19; 2nd primary equals the 9th.

♂ Bill 12.5 and 8; wing 65; tail 49; 1st primary 18; 2nd between the 8th and 9th.

♂ Bill 13.5 and 9; wing 66; tail 49; 1st primary 19.5; 2nd equals the 10th.

9,000', ♂ 27.4.12. Bill 13 and 9; wing 64; tail 49; 1st primary 17; 2nd equals the 10th.

10,000', ♂ 27.4.12. Bill 14 and 9; wing 65; tail 49; 1st primary 18; 2nd equals the 9th. Average male wing measurement, nearly 64.9.

♀ 22.5.12. Bill from base, 12.5, from feathers 8.5; wing 58; tail 46; 1st primary 16; 2nd equals the 10th.

During a month's sojourn in the Eastern Dooars I found a Warbler, the exact counterpart of the former birds, differing remarkably in size. It was more plentiful in the open, cultivated country of the plains, frequenting the bamboo "baris" around the huts of the villagers, than it was in the heavy forest outskirts, in both of which localities I obtained specimens, but failed to make the most of my opportunity, as I merely put them down to "*lugubris*." The differences have only been brought out by comparison. This has necessitated an examination of my Assam material.

SERIES B.

Kumargram, (Plains) Jalpaiguri, Eastern Bengal.

(a) ♂ ad. 9.1.22. Bill from base 13, from feathers 9.5; wing 59; tail 45; 1st primary, 17; 2nd equals the 10th.

Bhotan Ghat, (Base of Hills) Eastern Dooars.

(b) ♀ ad. 22.1.22. Bill from base 12, from feathers 9; wing 55; tail 41; 1st primary 16; 2nd equals the 10th.

Gauhati, (Plains) Lower Assam.

(c) ♂ ad. 12.2.12. Bill from base 12.5, from feathers 8; wing 59; tail 42; 1st primary, 18; 2nd equals the 8th.

In all three examples the greater wing-coverts are faintly tipped with greenish white. The crown in the female is dark and only matched in this character by one male of the A series. Notwithstanding, No. (c) has a different wing formula, it appears to be nearest to this race. This specimen and the following five detailed below were recorded in my "Notes on the Birds of Upper Assam" under *P. nitidus plumbeitarsus*, Swinh. and my identification is confirmed by others owing to the presence of two wing-bars, which are either greenish-white or greenish-yellow. This character appears to be present in birds-of-the-year in this form of *P. lugubris*, whereas the tips of the greater wing-coverts in "*plumbeitarsus*" are often of a more defined white; these specimens agree in the general dark coloration with "*lugubris*" even if the wing formula does not in some examples.

SERIES C.

Rungagora, (Plains) Upper Assam.

♂ 16.9.03. Bill from base 13, from feathers 9; wing 58; tail 42; 1st primary, 19; 2nd equals the 10th.

Silonibari, (Base of Hills) Upper Assam.

♀ 30.8.11. Bill from base 13; from feathers 8; wing 58; tail 43; 1st primary 17; 2nd equals the 9th.



Dejoo, (Base of Hills) Upper Assam.

♂ 12-9-10. Bill from base 14.5, from feathers 9.5; wing 61; tail 44; 1st primary 19; 2nd between 7th and 8th. ♂ 11-9-10. Bill from base 12.5, from feathers 8; wing 60; tail 47; 1st primary 18; 2nd equals the 9th. ♂ Bill from base 12.5. from feathers 9; wing 59; tail 42; 1st primary 19.5; 2nd equals the 9th.

The arrival of this Warbler at the foot of the Hills and in the Plains of Upper Assam at the end of August and in the second week of September before the termination of "the rains" may or may not have any significance in reference to a short journey from their breeding grounds, but the small birds in Series B, I venture to surmise will be found to be a form breeding somewhere in the foot-hills with probably only a limited extension into the plains at the cold weather and this may be the solution of the status of the birds in Series C, as these measurements average less than the birds in Series A, which are typical "*lugubris*" but here again these measurements are in excess of Dr. Hartert's. Wing, 59-62, seldom only 57, frequently up to 64.5. My shortest and longest measurement is 55 and 66 respectively, when birds from the combined areas are taken into consideration.

*P. nitidus plumbeitarsus* is very close to *P. lugubris*. The only reliable characters are the "whitish underside", "very pale on the throat"; the under wing-coverts and axillaries are brighter, the breast is generally stippled with yellow as occurs in "*trochiloides*" and a "finer 1st primary." Whilst the wing formula, 2nd between the 7th and the 8th, is fairly constant, some examples of "*lugubris*" are similar in this respect, as well as having the double wing-bar, but a difference in some of the before mentioned characters will suffice to eliminate "*lugubris*" when a series is compared. In general "*lugubris*" is coloured a more "dusky-olivaceous below and above" and sometimes has a darker head. When "birds of the year" from Upper Assam are concerned, the difficulties are apparent, which is not the case with typical birds from Sikkim. "*plumbeitarsus*" also appears to be a slighter bird which would be more obvious in life. As there is such an appreciable difference in the size of the sexes in all the species of *Phylloscopus* it is most essential that the measurements of each sex be stated separately.

Blanford speaks of his specimens from the far interior at high elevations as having distinct whitish tips to the wing-coverts. These specimens may well have been "birds-of-the-year."

#### 148. Blyth's Crowned Willow-Warbler *Phylloscopus trochiloides* (Sundev.).

Recorded in summer as having been observed in the Himalayas from Kashmir to Sikkim and as "probably wintering in the lower valleys of these parts." A series of four ♂♂, three ♀♀, obtained at Bhotan Ghat, (Base of the Hills) Raidak River, Eastern Dooars, 20--24-1-22. Gopaldhara, Rungbong Valley, Darjeeling, 3,750', ♂♂ 2-10-19, 5,500', ♂ 4-11-20. 3,500', ♂ ♀ 25-3-11. 6,000'-♂ 25-3-20. Mai "Khola", East Nepal. 8,500', ♂ 27-4-12, give its zonal distribution fairly accurately during the "cold weather" months and towards the breeding season, as there is little doubt that it breeds at 6,000' and upwards. I have since found the nest containing a juvenile cuckoo, June 1923, at 6,300', above Seeyok.

Thirteen specimens examined :

♂ Bill from feathers at base 9-10, av. 9.2; wing 56-60, av. 58.6.

♀ " " " " " 9-9.5, av. 9.1. wing 55-58; av. 56.3.

Soft parts: Iris hazel (hazel-brown); bill, upper mandible dusky yellow, lower mandible yellow or pale yellow; tarsus pale yellowish-plumbeous (yellowish-green); soles paler yellowish-plumbeous (deeper yellowish-green).

All these specimens have the two outer tail feathers slightly margined on the inner web with white.

I have not obtained this Warbler in the Interior of Sikkim. It is evidently confined to the Outer Ranges during the breeding season, descending to lower limits during "the cold weather."

**149. The Allied Flycatcher-Warbler. *Cryptolopha affinis* (Horsf. & Moore).**

Observed plentifully in the *Tista Valley* where it has been obtained up to an elevation of 5,800'. (G. E. Shaw). I have failed to locate it in the Rungbong Valley at anything approaching this elevation. All my records refer to *C. poliogenys*. It is somewhat a difficult matter to discriminate between the two species, even when observed at close quarters under good conditions.

**150. The Black-browed Flycatcher-Warbler. *Cryptolopha burkii burkii* (Burton).**

Apparently this Flycatcher-Warbler has the widest zonal distribution in comparison with the other members of this genus. Common on the *Singile La Ridge* at 10,000' in April and May. Obtained in Nepal and Sikkim. Numerous records from 3,400' and upwards in the Rungbong Valley, and obtained as low as 2,000' in the Tista Valley. (G. E. Shaw). There is every likelihood that it occurs at much lower limits during the cold-season, yet it is strictly not migratory, and it was observed on numerous occasions in the Eastern Dooars in January 1922. Obtained at Bhotan Ghat on the Raidak River, ♀ 24-1-22. Blanford obtained one specimen at Lachung on the 28th September.

Eight specimens examined :

♂ Wing 58-60, av. 59.2. ♀ 53-56, av. 54.

These measurements average slightly larger than a series of five specimens from Assam. ♂ Wing, 57-58, av., 57.7. ♀ 52-53, av., 52.5.

This difference is not surprising and might almost be expected, as more frequently than not, specimens of all these small and other Warblers which have been obtained at the extreme upper limits of their zonal distribution, have a tendency to show a larger wing measurement than other specimens obtained at lower levels, in species which merely move to some slight extent according to season.

**151. Brooks's Grey-headed Flycatcher-Warbler. *Cryptolopha xanthoschistos jerdoni* (Brooks).**

Hodgson speaks of this form and the typical bird as breeding in Sikkim and Nepal up to 6,000' or 7,000'. It occurs commonly at all elevations up to 5,000 and obtained above Mangpu at 5,300, (G. E. Shaw). Generally distributed over the whole area, and apparently the most plentiful of all the Flycatcher-Warblers.

A series of three ♂♂, eight ♀♀ Sikkim skins measure :

♂ Bill from feathers at base 7.5-8.5, av. 8 ; wing 52-55, av. 53.6.

♀ " " " " " 7.5-8.3, av. 7.6 ; wing 50-55 ; av. 51.7.

In comparison a series of six ♂♂, two ♀♀ Assam skins measure :

♂ Bill from feathers at base, 7.5-8, av. 7.8 ; wing 48.5-54, av. 50.6.

♀ " " " " " 7.3-8, av. 7.6 ; wing 47-50, av. 48.5.

One Bhotan Dooars specimen ♀ Bill from feathers at base, 8 ; wing, 49.

Sikkim birds on the whole certainly show more ashy-grey colour on the forehead, crown and nape in comparison with Assam birds which are typical in having these parts coloured blackish-ashy. The measurements however prove the former to be this race.



**152. The Grey-cheeked Flycatcher-Warbler. *Cryptolopha poliogenys* (Blyth).**

Occurs in moderate numbers around Gopaldhara at 4,700' in the Rungbong Valley, and observed sparingly around Kalo Pokhari at 10,160' on the Singile La Ridge in April and May.

**153. The Chestnut-headed Flycatcher-Warbler. *Cryptolopha castaneoceph* (Hodgs.).**

Generally distributed at all elevations up to 6,500' at all events.

Apparently more plentiful from about 4,500'-6,000'. Obtained above Mangpu at 6,300', (G.E. Shaw). Mai "Khola", East Nepal, 26-4-12; Gopaldhara, 4,720', 3-11-20; 5,000', 1-11-18. Namsoo, 2,100'; 13-3-14. A party of about fifteen of these birds amongst which was intermingled a small assortment of *Abrornis albogularis* and possibly an odd pair of *C. cantator*. Bhotan Ghat, Raidak River, Eastern Dooars, 23-1-22; obtained and observed on other occasions. It more often than not keeps to the leafy branches of the lofty trees, and does not frequent the lighter, yet denser vegetation, to the same extent as the other members of the genus.

Semana-Mirik Ridge, 6,000'-6,500', May, June 1923. I found six nests in all containing both eggs, in one instance a single egg of *Chalcococcyx maculatus* along with the three eggs, one of which was broken, slightly incubated and forsaken on the 22nd of May and in other two cases, single juvenile cuckoos of this species, females, the sole occupants. On the second occasion I visited one of the latter nests at dusk; I was struck by the chestnut head being so prominent as to lead me to believe the parent bird was in possession.

Whilst it would be, perhaps, rash to hazard a guess that the majority of the eggs laid by this Cuckoo in this *Cryptolopha's* nest will prove to produce females and that the eggs laid, for instance in the nest of *Athopyga saturata* will turn out to be males; yet it would only be in keeping with what we might expect of nature's harmonizing methods.

It builds in the dark recess of an overhanging bank, constructing the usual compact cup-shaped nest of moss, like its congeners with the entrance more often than not facing the bank and opposing its main means of ingress and egress. Although its habits in nidification allow of careful concealment; there is little doubt it suffers depletion of its numbers and eggs through the wiles of snakes, when the brooding parent bird completely disappears with its charge.

The full complement of pure white eggs, steel transparent, is three.

A small party seen on the 13-6-23\* were probably composed of the parents and young.

Four specimens examined; wing, 48-50, average, 49, which similarly compares with Assam specimens. The measurements show no appreciable difference between the sexes, which a large series would possibly refute.

Soft parts: Iris brown; bill upper mandible dark horny, lower mandible pale horny; tarsus dusky-horny.

**154. Tickell's Flycatcher-Warbler. *Cryptolopha cantator* (Tick.).**

Mandelli obtained numerous specimens of this species which are in the National Collection, but it appears to be locally distributed, and only occurs sparingly at moderate elevations. Obtained on one occasion at Gopaldhara 3,500', in the bottom of the Rungbong Valley, 25-3-11, ♀ Bill from feathers at base 9; wing 51

**155. The Yellow-bellied Flycatcher Warbler. *Abrornis superciliaris superciliaris* Tick.**

Confined to *low elevations* only. Great Rangit Valley, 18-2-20.\*  
Obtained up to an elevation of 3,300' in the Tista Valley. (G. E. Shaw).

**156. The Black-faced Flycatcher-Warbler. *Abrornis schisticlps schisticeps* (Hodgs.).**

Generally distributed but far from common and with a *restricted zonal distribution*. Obtained around Gopaldhara up to an elevation of 5,800', apparently not to be found below 5,000', also obtained above Singhik at 5,200', in the interior of Sikkim, 12-3-20, one ♂ secured; several noted in a mixed party of *Cryptolopha*, *Periorocotus*, and in forest, on lofty trees. Gopaldhara, 5,000', 26-2-19, ♂ testes enlarged; shot out of a large party of mixed species of small birds, in heavy forest. 5,500', ♂ 14-11-20, noted as a difficult optical task to distinguish between this *Abrornis* and *Chelidorchynx hypoxanthum*; both of which species were mixed up with *Minla*, *Ixulus flavicollis* and other small Warblers; the open tail and short flights of *Chelldorchynx* were of course distinctive and it was only when this trait in this Flycatcher was observable the Flycatcher-Warbler could be identified with certainty.

Three specimens examined:

♂ Bill from feathers at base 6.5; wing 48.

Soft parts: Iris red-brown of a defined tint; bill dark ochreous-horny (pale brownish-horny),—a somewhat unusual colour for the bill in comparison with its near allies; tarsus olivaceous-horny (dusky-olivaceous); claws similar.

**157. The White-throated Flycatcher-Warbler. *Abrornis albogularis albogularis* Hodgs.**

Only found at *low elevations* probably not exceeding 2,500 or thereabouts. Observed in the Great Rangit and Tista Valleys, also in the Balasan Valley, Namsoo to Panighata.

**158. The Broad-billed Flycatcher Warbler. *Tickellia hodgsoni* (Moore).**

Observed and obtained on numerous occasions in the Rungbong Valley from 2,800', *July*, to 6,000', *March*, and there is no doubt *these limits are exceeded in an upward direction*. Gopaldhara, 3,800', 19-7-21; \* 5,900', ♀ 17-2-18; 5,800', ♂ 6-2-21; 6,000', ♂ ♀ 25-3-20,\* in scrub-growth, every indication of their being about to nest, 4,200', ♂ ♀ 10-10-17.\* 3,700', 14-4-23,\* a pair in evidence. 5,800', 24-5-23,\* a pair in company with a mixed assortment of small birds.

*This Flycatcher-Warbler has very much the same habits as Horornis.* It keeps to the dense undergrowth, and though its high pitched note and bright coloration is apt to cause it to be more easily located; it is only on rare occasions, it may be observed to advantage. Due to this trait in its habits I have been entirely misled; as I had been under the impression all the birds that had come under my observation were *Phyllergates coronatus*. On comparing my Assam skins of the latter, it was then only apparent, as there is no likelihood of this Tailor-bird, which could only possibly occur in the foot-hills, ever being located at similar elevations. Had I only examined the bills of the few obtained, apart from my disinclination to shoot what I rightly regarded as a none too plentiful and interesting bird, my mistake ought to have been apparent; instead of which my interest has always been centred on the tops of the trees, wondering if ever I should be fortunate enough to locate one of the few rare birds whose whereabouts had so far baffled me. Even the field-ornithologist, left to his own resources, has his difficulties.



Two specimens examined :

♂ Bill from feathers at base 8.5 ; wing 47.5. ♀ Bill 10 ; wing 46.5.

**159. The Aberrant Warbler. *Neornis flavolivacea flavolivacea* Blyth.**

Dr. Hartert considers this Warbler congeneric with the four species to follow which are all included in the genus *Horeites*.

In common with other near allies, probably only breeding at high altitudes and descending to the valleys in the winter. The distribution as given by Oates is conflicting. Himalayas, 6,000'-10,000', "breeds 3,500'-6,000'" and is evidently a mistake. Obtained near Kalo Pokhari in East Nepal at 10,000', ♀ 7.5-12. Bill from feathers at base, 10 ; wing, 54.5. Gopaldhara, Rungbong Valley, Darjeeling, 3,500', ♂ 13.2-19. Bill from feathers at base 10 ; wing 57. Well represented in the B. M. Collection, May, June, August, October-December (Mandelli).

**160. Hume's Bush-Warbler. *Horornis acanthizoides brunescens* (Hume).**

Obtained near Kalo Pokhari, in East Nepal at 10,000', ♀ 29.4-12. Bill from feathers at base, 9 ; wing 50. Above Karponang, in the interior of Sikkim also at 10,000', ♂ 24.3-17. Bill feathers at base 8 ; wing 52. On the latter occasion procured in dense "prong" bamboo thickets, a habitat similarly frequented by *Conostoma aemodius*. Well represented by Mandelli's Sikkim specimens in the B. M. Collection, January, February, April, November, but most without any data as to exact localities.

**161. The Strong-footed Bush-Warbler. *Horornis fortipes fortipes*. Hodgs.**

Occurs commonly around Gopaldhara, descending to the bottom of the Rungbong Valley in winter. Obtained at an elevation of 3,600' in the Tista Valley, (G.E.Shaw), and also at Chungthang at 5,500', on the 26-2-20 ♂, in dense bamboo growth. Gopaldhara, 3,700', 18-4-23, in evidence in a favoured locality, with its high-pitched long drawn out note and a subsequent short trill, otherwise difficult to locate as the few odd birds rarely showed themselves for anything but a brief interval. There is some individual disparity in size as the following measurements show :—

Four specimens examined :

♂ Bill from feathers at base 8.5-11, av. 9.8 ; wing 50-57, av. 54.

♀ " " " " " 9 ; wing, 49.

Seven Assam skins for comparison measure :—

♂ Bill from feathers at base 9.5-10, av. 9.8 ; wing 50-56, av. 52.

♀ " " " " " 10, av. 10 ; wing 48-53, av. 50.

**162. Blanford's Bush-Warbler. *Horornis pallidipes* (Blanf.).**

Recorded as "breeding in Sikkim, Ging and Lebong near Darjeeling, May to June." Represented in the B. M. (Hume Collection) by 8 Sikkim skins, March-May, August, 1875-79, (Mandelli). 2 skins May, 1875, (Tweedale Collection.) and 4 skins from the Bhotan Dooars, January and April, 1876-77. (Mandelli).

**163. The Large Bush Warbler. *Horornis major* (Moore.).**

Recorded for Sikkim. "breeding high altitudes (Lachung.) in July." Represented in the B. M. Collection by 13 specimens, April-June, August, October, November 1872-76 (Mandelli). 1 specimen L. A. Waddell and a ♀ 23-10-70. Senchal 8,000', (Blanford).

**164. The Golden headed Warbler. *Phyllergates coronatus* (Jerd. & Blyth).**

Recorded for Sikkim. Probably confined to the base of the hills and the valleys of the interior at low elevations. There is a specimen dated February 1873, Mangpu and many others from Sikkim.

**165. The Rufous-capped Bush-Warbler. *Horeites brunni-frons* (Hodgs.).**

A cold-season visitor to the Rungbong Valley descending to 3,600' and possibly much lower, ascending to 10,000' and over on the *Singile La Ridge*, at and about which elevation it breeds. Obtained around Mangpu at elevations of 3,600'-3,900' during the cold-weather, (G. E. Shaw). Gopaldhara, 4,000', 28-1-19.\* 6,000', 26-12-20. Mai Valley, East Nepal, 8,000' and upwards, ♀ 18-3-12. ♀ 28-3-12. ♂ 4-12, evidently on the upward migration, extending up the valley with the advent of warm weather. Kalo Pokhari, 10,160', ♂ 12-4-12; ♂ 16-4-12; ♂ 25-4-12. ♂ 12-5-12; ♂ 22-5-12; males much in evidence. During the first weeks in April it utters a loud, sweet, if short song. Nests composed of grass and bents with an interior lining of feathers; clutch, usually four, on one occasion five eggs. Blanford records it from the Lachung Valley at 10,000'-12,000' (September).

Nine specimens examined:

♂ Wing 45-49, av. 46.9; ♀ 44-47, av. 45.4.

The measurement of the bill varies little in either sex being 8.8-5.

Soft parts: Iris hazel; bill dark horny, basal half of lower mandible pale yellowish-horny, darkening towards the tip; tarsus pale brownish-horny.

**166. The Brown Hill-Warbler. *Suya crinigera crinigera* Hodgs.**

Recorded as occurring upto 6,000' in the Himalayas. I have failed to obtain it on the Western side of the District of Darjeeling. It has some *status to the East*, where it has been obtained in the *Tista Valley* at elevations of from 2,800'-3,900' around Mangpu by Mr. G. E. Shaw. This species is well represented in the B. M. Collection from the Sikkim Himalaya and a number have reference to the lower hills around the Tista River, where Gammie stated it bred up to 3,500'.

**167. The Black-throated Hill-Warbler. *Suya atrogularis* Moore.**

"Chiboorchay" Paharia

Gammie is mentioned as having found this species breeding around Mangpu, but so far Mr. G. E. Shaw has not obtained it from this same locality. There may be some error in reference to its nidification in this area. I could find none of Gammie's specimens in the B. M. Collection. It occurs commonly both in *East Nepal*, in the Mai Valley up to 7,000' and numerous as a resident, breeding species in the Rungbong Valley of the Sikkim Himalaya at elevations of from 3,400'-6,500', at all events. I found the nest on the Semana-Mirik Ridge, containing the full complement of four eggs, at an elevation of about 6,700', 6-5-23. Mr. C. M. Inglis has obtained it in summer at Jore Pokhari 7,400' and at Rinchenpong 6,000'. Oates doubts Hodgson's specimens as having come from Nepal. I have no knowledge of its western limits beyond where it was obtained.



**168. The Ashy Wren-Warbler. *Prinia socialis socialis*  
Sykes.**

Recorded for the Lower Ranges of the Himalayas upto 4,000'. This species is well represented in the B. M. Collection by numerous specimens from the Bhotan Dooars collected by Mandelli, and others in the Seebohm Collection evidently Mandelli's skins also, with no definite data excepting the locality Sikkim. Its exact status in the valleys of the interior is obscure.

( *To be continued.* )

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## REVIEWS.

BUTTERFLY LORE. BY H. ELTRINGHAM, D.Sc., M.A., F.Z.S., F.E.S.,  
CLARENDON PRESS, OXFORD. PRICE s. 4-6.

(180 pp., 1 coloured plate, 52 text figures,  $5 \times 7\frac{1}{2}$ ).

The title of this book is somewhat misleading. It deals equally with Butterflies and Moths: it is not concerned with descriptions or classification; it does not teach the reader how to catch butterflies or how to preserve them. The object of the book is to set forth in simple language certain interesting details of insect life. The life history is described in detail, chapters being devoted to the egg, caterpillar, chrysalis and perfect insect. Then follow descriptions of the senses, scents, methods of concealment, mimicry and polymorphism. The geological record in respect of butterflies is lightly touched upon and there is a chapter dealing with the relations between butterflies and ants.

The subject is treated in a light vein and there are no technical terms or intricate scientific descriptions. The whole book is absorbingly interesting from start to finish and one is amazed at the revelations obtained by the use of a high power microscope. The most interesting chapters are perhaps those on mimicry and on the senses of butterflies and moths. The various artifices that insects employ in order to keep their place in the acute struggle for existence are simply marvellous. Most people are aware that many butterflies mimic others that are distasteful to enemies and that many again are coloured so as to resemble their surroundings, but it will be news to many of us that there are caterpillars provided with poisonous hypodermic syringes, others with fiendishly shaped poisoned spikes, and so on. It is shown that butterflies and moths have but poor eyesight, though the structure of the eye is extraordinary and entirely different to that of a mammal's. The sense of hearing is doubtful though, as in a few exceptional cases the insects can make a noise, it is reasonable to assume that their mates can hear them; in some moths there appears to be a well developed ear on either side of the body. The senses of touch and taste are undoubtedly more or less developed. But it is the sense of smell that in certain instances is so extraordinary, while a very large number of the insects are provided with a wonderful scent producing apparatus. In addition it is suspected that insects have a sixth sense that we do not possess and can only imagine with difficulty; that is sense of what may be called gravity, which permits a butterfly to sweep through dense forest at great speed without touching a twig in spite of its poor eyesight. The microscopic examination of a butterfly's feelers or antennæ reveal the presence of four distinct types of organs, the uses of which are little known; additional organs are contained in the palpi, which are appendages in front of the face on either side between the eyes.

The ordinary reader will find the book full of interest while for the expert naturalist there is a great deal of matter that he will find new to him, that has been gained from recent experiments and discoveries.

W. H. EVANS.

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A BIBLIOGRAPHY OF FISHES. By BASHFORD DEAN and others. 3 volumes.  
(Vol. I, 1916; Vol. II, 1917; Vol. III, 1923: New York). Published  
by the American Museum of Natural History in the Science  
Education Series.

Ichthyologists and naturalists in general owe a deep debt of gratitude to the American Museum of Natural History, and to Professor Bashford Dean and his colleagues Messrs. C. R. Eastman, E. W. Gudger and A. W. Henn, for their *Bibliography of Fishes*, the third and last volume of which has just appeared. Each volume consists of over 700 pages of close print. The first two contain a



catalogue of all papers on recent and fossil fishes published from the year 1758 the items arranged alphabetically under the author's names; while the third contains a subject index and much miscellaneous information such as "Titles of Pre-Linnean Publications," "List of Periodicals relating to Fish and Fisheries", etc. The subject index is arranged in three main sections, (a) Morphological and general section, (b) Systematic section and (c) "Finding index."

The value of bibliographical work on so comprehensive a scale can hardly be exaggerated at the present day, when biological investigations of all kinds are hampered by the publication of an enormous mass of uncorrelated details. So far as we have been able to test the volumes published by the American Museum of Natural History the work has been done with the greatest possible care and extremely few references have escaped the notice of its authors. We congratulate them on the completion of an unusually important, laborious and careful investigation, which is of infinitely greater value to the cause of science than much so called original research.

N. ANNANDALE.  
S. L. HORA.

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WILD ANIMALS IN CENTRAL INDIA. BY A. A. DUNBARBRANDER, F.Z.S., F.R.G.S., Conservator of Forests. London, 1923; Edward Arnold; pp. xxii+296, 19 plates; price 18 Shillings, nett).

It has often been remarked that the writing of books on "Shikar" in India has been overdone, and this, in respect to some previous publications, has been said with some justification.

The book under review *Wild animals in Central India* by Mr. A. A. Dunbar Brander comes under a very different category, and will be welcomed by sportsmen and field naturalists as an interesting and accurate work, useful to those with experience and invaluable to novices. It is the result of diaries and notes kept during twenty-one years passed in the Forest Service, and shows that the author has indeed learnt "to grow wise in more than woodlore alone."

Mr. Dunbar Brander tells us that during about six of his twenty-one years he practically ceased to shoot, and says, "It is to this period that I am chiefly indebted; one can see so much more of an animal, and under such different circumstances, if one is intent on not killing it." How very true this is all sportsmen know.

The object of the book is described by the author to be to supply information to the field naturalist and sportsman who takes an intelligent interest in the animal he is hunting. It does not claim to be a guide to the hunting and killing of the various animals dealt with. To the reader of experience, however, it will be abundantly evident that the volume is a guide both to sportsmen and field naturalists; and the author can be assured that all who read his book will derive both pleasure and profit from its perusal.

The arrangement of the book is good, and the writer expresses his meaning in a clear and attractive manner. One wishes that the index had been more full, and that there could have been more than the nineteen illustrations from photographs; some of which might have been better, that of the two wild bears in particular.

Twenty-four pages, full of incident and interest, are given to the habits of the sloth bear, to which animal the author accords pride of place, in matter of intelligence, over all the beasts in the jungle, the Primates excepted; and in the reasons given for this view he takes the reader with him. In addition to telling us all there is to know concerning the sloth bear, Mr. Dunbar Brander breaks new ground as to his habits and character; and also sets out to lay at rest certain errors which, he considers, have been handed down from the earliest writers.

As to the known fact that the sloth bear has a very strong sense of smell, as far as his food is concerned, and the anomaly that this animal is certainly not difficult to approach when stalked or hunted, the author propounds the theory that this bear is "short-scented" and fully explains what is meant by this term. The theory is probably correct: and sportsmen will be interested in confirming it by taking particular notice of the direction of the wind, in their future pursuits of "bruin" and so ascertaining whether, and at what distance, an adverse wind affects the hunter's approach.

In regard to the manner of attack on human beings, our author is still on controversial ground. He says he has never known bears, in seizing their enemy, to stand upon their hind legs or attempt to hug: and that their usual method is to knock the man over and burrow off his face and scalp with their fore paws, adding that on occasions they will bite, but that they chiefly rely on their fore-paws as their chief weapons of offence. A sloth bear certainly does not hug his enemy. That is a popular legend not founded on fact. But it cannot be said that it is unusual for an attacking bear to stand up on his hind legs; or that the fore-paws are the chief weapons of offence. Your reviewer's experience is to the contrary; and in no case have wounds inflicted by sloth bears on human beings been found to be from claws. The question could be satisfactorily settled by medical reports from an area where injury by bears is of frequent occurrence.

Other habits also are discussed and the character of the beast illustrated by amusing anecdotes. All who know "bruin" will agree that his manners are uncouth, his character uncertain, and that he is a very real danger in the forests to unarmed people. Regarding the wild dog, a photograph of which would have been a welcome addition to the illustrations, the author has much to say, a good deal being new and interesting matter. The species is unpleasantly common in the jungles of Central India and we are told how to destroy these pests by means of an emulsion of strychnine, the strength of which is wisely not given, but is known to those properly interested in the matter. Their manner of hunting and killing is described; the story that they are in the habit of emasculating the animals they attack being discredited from personal observation. This is only one of a number of such observances by which the value of this work is enhanced. The chapter is full of interest.

In respect of tigers and their ways our author writes in the light of a wide experience and intimate knowledge, having shot, and seen shot, upwards of two hundred tigers; besides having to his credit the years of observation, without shooting, which have already been mentioned. The subject is dealt with in two chapters entitled "Distribution—Size and Habits" and "Tiger Hunting."

The question of the twelve-foot tiger is sufficiently discussed, and some authoritative weights and measurements of exceptionally large animals are given. The reader will find much regarding the habits of the tiger that is of great interests. Mr. Dunbar Brander is able, from personal observation, to give a detailed description of methods of killing, as against the conjectured accounts of so many other writers. It is satisfactory to read that our author wholly discounts the story for it is nothing else—that tigers and panthers suck the blood of the neck. Because, from time immemorial, a bear has been said to hug his enemy, therefore he must do so: because a tiger is a blood thirsty animal, therefore he sucks the blood of his victim. These are popular beliefs and difficult to dispel. And in regard to the latter which is so deep-rooted among jungle people and Indian shikaries as to be practically ineradicable, the sportsman will be wise to allow the harmless legend to continue and so avoid being held to be an ignorant person. All readers with experience will agree that the tiger hunts wholly by means of sight and hearing, and has very little sense of smell. This, and the marvellous sense of locality—shared by tigers and panthers alike—is illustrated from observations of a tame tiger which the author once possessed.



To extract more than this from the book would be unfair to the author : suffice it to say that even the most experienced will find something that is new to them, and any future writers will find it difficult to add to the wealth of information furnished by Mr. Dunbar Brander.

Of "tiger-hunting," as carried out and suitable to the jungles of Central India, the author gives us much that is sound and sensible. Stalking on foot and shooting the animal on his kill : hunting with dogs and shooting the bayed tiger on foot : accompanying village cattle to graze and shooting the marauder while its vigilance is lost in the ecstasy of killing : sitting up over the kill : and, lastly, beating. All these methods are discussed and dealt with, the last named being that most strongly advocated, a conclusion with which all will agree. Mr. Dunbar Brander bars the use of the electric lamp for night shooting, considering that it does not give the tiger a fair chance, and pertinently asks "if we once admit the electric lamp where are we to stop?" The practice of shooting tigers with aid of artificial light has been officially prohibited in the Forests of the United Provinces : and most sportsmen will agree with the author that, except to get rid of a pest, or, it may be added, in such dense jungles as absolutely prohibit any other method, the use of electric torches oversteps the mark of what should be held to be sporting.

Some twenty-five years ago the late Mr. Reginald Gilbert contributed to the Journal of the Bombay Natural History Society an article designed to reduce the number of casualties to sportsmen by telling them what to do and what precautions to take when following up a wounded tiger : and our author tells us that in 1916 the number of casualties which took place induced him to draw up a few simple rules with a similar object. These are reproduced in the present volume and it would be an excellent thing if this summary of "rules and precautions to be taken so as to reduce risks in tiger shooting" were printed and issued with all shooting passes.

Very excellent advice as to what description of weapon to use is given, as also an instance of the uselessness of firing at a tiger with a high velocity small bore. Some instances of failure of even the heaviest weapons are recited. To all the author has to say, one thing, obvious though it is, may be added, and that is : "it is the first shot that counts the most and that shot should be taken with all possible care so that the bullet will strike or reach a vital spot. An initial shot, fired with insufficient deliberation, may have disastrous results."

Of leopards or panthers there is a somewhat less full account than of the tiger : but practically all is said that the subject requires. The question as to whether the tiger or the panther is the more dangerous, from the sportsman's point of view, is discussed ; and some weights and measurements are given. Habits and character are illustrated by suitable incidents and the chapter generally gives a sufficiently full account of the panther and his ways. The author rightly rejects the contentions of some former writers who have tried to divide *Felis pardus* into two, and even three, species, based on size or number of caudal vertebrae, etc., and tells us that throughout the length and breadth of the land there is but one *Felis pardus* : a beast of great variability in size and colouring, these being more or less occasioned by food supply, habitat, etc., etc. As to shooting of panthers by aid of artificial light we are told "as leopards can be considered vermin pure and simple, the ethics of how they are killed does not arise." May sportsmen trap or poison them ? Wild dogs may be poisoned, so why not panthers ! We think that *Felis pardus*, indomitable beast that he is when wounded, and no mean antagonist at any time, deserves a higher status than that assigned to him.

Gaur and buffalo are dealt with in one chapter, the former animal being better known to our author than the latter. That bison are dangerous animals to hunt is shown to be a common error, with which conclusion those who have the necessary experience will be in full agreement. This noble denizen of our Indian

jungles is fully and accurately described, some measurements are given, the weight of one animal is recorded, and instances in illustration of their poor sight but excellent sense of smell are related. There is no finer sport to be had than bison shooting with the aid of trackers. The author touches upon this and other methods of hunting this animal. Your reviewer would put the case against driving of bison stronger than does the author, and for a different reason, and bar it altogether as "overstepping the mark." Measurements to indicate the huge dimensions attained by the Indian wild buffalo are given and some recorded weights and measurements are referred to. Buffalo in Central India, and adjacent parts of the country, are now so diminished in numbers, that but few of the future generation of sportsmen will be able to include among their trophies the imposing horns of this animal from anywhere outside Assam and Bengal. The tracking of buffalo is a sport equal to that obtained in pursuit of the bison, with a more exciting element in it, as this animal is undoubtedly more dangerous to deal with, when wounded, than is the bison; though it is to be doubted whether he is so invariably dangerous as is popularly supposed: at least that is the opinion of the present writer based on experience including the following on foot of two wounded bulls.

The largest of the deer tribe in India—the Sambur—is dealt with in fullest detail, and we are told all there is to know about the species; indeed it may be said that the most experienced sportsman could add nothing to the information given. Sambur in Central India run larger, both in horn and body measurement, than those from the Terai, Southern India, and other parts of the country. The largest and heaviest stag measured by the author was five inches less in height than the 64 inches to which Lydekker states the species attains. A sambur measuring 64 inches at the shoulder could certainly not be found outside Central India. The oft repeated story that old sambur stags do not shed their horns annually is rejected with sensible remarks to the effect that when a sambur in full horn can be shown to have been shot in August or September then the story may be worthy of further investigation. In this chapter, as elsewhere in the book, one meets with remarks and advice which should be borne in mind by all true sportsmen. The swamp deer, or "barasingha," of the Central Provinces, is less well known to sportsmen in general than either the sambur or chital, the extensive information given in the present volume being therefore all the more welcome. Illustrations from photographs of the horns of both this deer and of sambur show the more usual of the various types which are met with. The author says that swamp deer are far more immune, and suffer less casualties, from rinderpest and foot and mouth disease, than do sambur and bison. It would be interesting to learn why this should be the case. Marked differences between the swamp deer of the Central Provinces and those of the Terai are brought to notice and commented upon, so giving rise to conjecture as to which of these areas was the original habitat of the species. Our retiring little friend the barking deer: muntjac: rib-faced deer: kakur, etc., as this widely known animal is variously designated, is the smallest of the deer tribe to be found in the Central Provinces. The several peculiar characteristics of this interesting animal are discussed. Concerning the much debated point as to how the "castanet" noise is made by these deer, the author concludes that it is merely a modified form of the usual cry of alarm, the sound being jerked out while the animal is in motion at the time. That it is a voice cry is probably correct, and confirms the conjecture of the present writer. Why should the kakur, when slightly alarmed, make noises with its feet, or its teeth, if indeed it can make such noises!—when the natural mode of expression would be the voice. Your reviewer has heard this noise made by a female kakur which has not got canine teeth. Instances of injury caused by the peculiar canine teeth of the male of this deer are recounted. Your reviewer once saw a case of a cow buffalo receiving a cut, nearly eleven inches long, by which it was in danger of being disembowelled,



from a male kakur which got among the herd and became frightened. The wound was sewn up and the buffalo recovered. It was not possible to say whether the injury was caused by the canine tooth, or the sharp edge of a chipped horn—most likely the latter. The cut was a clean one.

The antelopes are dealt with under one chapter, the nilgae or blue bull, the blackbuck, the chinkara, and the four-horned antelope being all described, habits discussed, and weights and measurements given. As might be expected the author is not able to tell us much that is new in regard to these well known animals. The elaborate arrangement of hairs inside the ears of chinkara, designed by Nature to protect them from flies and insects, is remarked upon. Black buck are similarly protected but in a lesser degree and camels have a very efficient "hair entanglement" of the same description. On the Indian wild pig we have a chapter entirely readable and informing, which, while not aspiring to deal with the pig except from a sportsman-naturalist's point of view, yet gives the novice an insight into the art of pig sticking. The "maxims for the novice" are amusing, and probably wholly effective in guiding those for whom they are intended. The field naturalist will find ample material upon which to reflect: and several things which he may not have himself observed. The concluding chapter deals with other jungle animals, the bats and rats being excluded, those only which are likely to interest the average sportsman are selected. And as regards these the author endeavours to confine his remarks to matters of special interest. Hyaena, wolf, jackal, fox, caracal or lynx, hunting leopard, wild cats, civets, mongooses, the Indian ratel, otters, squirrels, the mouse deer, crocodiles, python; all these are discoursed upon, and the reader will learn much that he did not know before. We are not told that the hyaena will attack and kill human beings; that has been known near Nowgong in Central India. Of the wolf the author has had little personal knowledge, so also in respect to the caracal, commonly misnamed lynx, and the hunting leopard, all of which are rare animals in Central India. About the ratel there is much said that is not generally known. The animal is very seldom met with. Natives hold them in great dread. We are told how to trap crocodiles, and how to shoot them, with much else besides. The last paragraph of this informing volume relates a remarkable instance of display of what appears incredible forethought and reason on part of a python. This however is the experience of a friend of the authors and not from his personal observations.

And so the pleasurable task of reviewing this excellent book comes to an end, with the closing advice, from your reviewer, to both the experienced and the inexperienced to take it with them into the Forests of Central India, and elsewhere, and add, if they can, observations of their own on the various animals so ably dealt with by Mr. Dunbar Brander.

R. B.

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HIMALAYAN AND KASHMIRI BIRDS. BY DOUGLAS DEWAR, I.C.S.  
(London 1923; John Lane: The Bodley Head Ltd.; pp. 200;  
price 7 Shillings and 6 pence nett).

We have received for review a copy of Mr. Dewar's latest book "Himalayan and Kashmiri Birds" which is intended to be a companion and complementary volume to his earlier "Indian Birds," so that the two books between them cover almost the whole of the Indian Empire, exclusive of Burma and Baluchistan.

As in the first work, the present volume is intended solely for the amateur ignorant even of the names of the commonest birds that he meets with in his rambles. Its scope is limited to the birds of Kashmere and the Himalayan Hill Stations ordinarily met with in the zone between 5,000—7,000 feet above sea-level and that in summer; a total of 179 species have been selected as fulfilling these conditions, and the number has been designedly kept as low as possible in the effort to avoid distracting the beginner by an "embarras de richesse."

The book is divided into two parts. Of these the second part is the more important and may be considered the main body of the work. It is a descriptive list of the 179 species under consideration, comprising their names, descriptions, habits and distribution, with their reference numbers in the "Fauna British India, Birds" and Jerdon's "Birds of India."

The first part of the book is intended to be a key to the second part, guiding the novice to identification of a bird by means of its salient characteristics in life. The key is divided into three sections. In the first of these the birds are classified by their structural peculiarities, such as bill, crest, tail and sexual dimorphism in so far as these points catch the eye of an observer in the field; in the second the classification is by salient points of colour; in the third stress is laid on habits and habitat.

The success of such a key of course depends on the closeness with which the author succeeds in estimating the points that strike the average observer. We have tested the key from that point of view and have found it work very satisfactorily.

The descriptive list is somewhat harder to estimate. Opinions may differ as to what species should have been included or omitted but on the whole the selection has been most judicious, except perhaps under the heading of "Warblers" a group with which Mr. Dewar is but slightly acquainted, as appears from the evidence of his previous books. The descriptions of plumage and habits are as clear and succinct as possible, with the limits imposed, but there is a good deal that is misleading in respect to distribution. It is a pity that Mr. Dewar did not have his proofs read by others acquainted with the Hill Stations which he has not visited personally.

We are glad to see that the book is free from the attacks on the scientific student that disfigure so many of Mr. Dewar's writings. But if Mr. Dewar desires to continue as an instructor of the public mind he must bring his work more up to date.

Here as elsewhere the reference numbers of the various species in Jerdon and Blanford and Oates are appended. Jerdon is worthy of all honour both as a pioneer and as a very fine field naturalist and descriptive writer; but to refer the novice to a work hard to obtain and whose classification and nomenclature are obsolete is of little value.

The references to the Fauna are important and should be cited. But the first edition of the Fauna to which all references are given is both out of date and out of print. One volume of the new edition has appeared, another is in the press, and the changes as a whole have been foreshadowed in the "Hand list of Indian Birds, which the author of the new edition has contributed to the Bombay Natural History Society's Journal. The binomial system has given place to the trinomial, and many old names have been disturbed in the revolution of nomenclature. Surely it would have been kinder to introduce the novice to the names which his generation will use and not to the names current when Mr. Dewar was himself a beginner. We may deprecate the changes but they are necessary whether we like them or not, and all change is not necessarily for the worse: to cite a case in point:—

Years ago the writer on his first visit to the Hills secured a lovely blue thrush which appeared to be common enough; yet search as he would he could not identify it in Volume II of the Fauna amongst the *Turdidæ* to which it most obviously belonged. Some forgotten chance revealed the bird as *Myiophobus temminckii* No. 187 in Volume I. The beginner's instinctive recognition of the species as a thrush has since been confirmed by the scientific world. Yet true to his text Mr. Dewar continues to show the bird as a Babbler, doubtless to the confusion of many another beginner. Here is a change that he might admit, and there are others that cannot reasonably be resisted. Growth and change are a feature of every healthy organism and to stand still is to admit defeat.

H. W.



## EDITORIAL.

The maxims of Wilkins Micawber do not find a place in the statement of accounts published on page 1067 of this number. Yet, in the manner of that well-meaning though much-embarrassed financier, our Honorary Treasurer might well have indicated the disastrous consequences which must inevitably result from pursuing a policy which produced such a decidedly unfavourable balance sheet.

“Our receipts (other than what should be treated as capital and amounts received on account of Game Books, etc.), as compared with expenditure, appear to show a deficit on the year of very nearly Rs. 10,000.”

The causes leading to this gloomy result are indicated—

“a decrease in subscription apparently due to the fact that twice as many members resigned from various causes as joined the Society.”

So much as regards decrease in our revenue, similarly on the expenditure side we appear to entertain our very especial “Ruhr” problem:—the cost of the Journal

“which shows a further increase of nearly Rs. 15,000 over last year, and now costs Rs. 11,400 more to print than it did three years ago, an increase of nearly 100 per cent. over 1920 printing charges.”

“Expenditure under all other heads shows a decrease.”

The source of our trouble stands revealed, namely—our anxiety to provide the members of this Society with a Journal which would make its arrival an event to be looked forward to; this has been our undoing, but appreciation of our efforts has not been wanting, witness the letter from a member, now retired from this country, who writes that he has changed his mind about discontinuing his membership, because he finds the Journal so interesting. An old Life Member, one of that fortunate class who came in when the Life subscription stood at Rs. 200 makes open confession:—

“After considerable thought I have come to the conclusion that I am obtaining too great value for the Rs. 200 Life subscription, when the cost of printing and prices in general are taken into consideration.”

Obviously in casting our bread plentifully upon the water we looked for some such response as this: we looked to a wider circulation, to an increased membership roll. But the harvest has been disappointing. Why have we failed? Is it possible that it is due to the lack of a keen interest and active co-operation on the part of members of this Society? May we, in return for our efforts to produce a good Journal, appeal to members for a fuller recognition of those responsibilities which make for more active membership? It has been suggested that the work of the Society is insufficiently advertised. “If you want a thing well known—speak about it to your friends”, thus Lord Leverhulme explains his phenomenal success as a salesman. A member writing from London advises us that he has bought a complete set of the Journal down to the end of the last volume, all being bound except the last volume, for £32. He adds “There have been quite a number of sets, but mostly incomplete, offered in London during the past twelve months and up to £40 has been asked. *I think if the Journal were better known over here that you would obtain a number of subscribers.* Certainly there is not in my opinion any Journal like it, and there are always interesting articles on Sport and Natural History in all its branches.”

Will members personally assist during the present year in making the Society better known among their friends and help to further their own interests by adding at least one new name to the membership roll? Another two hundred members would place our finances on a sounder basis and a guarantee would be afforded for the continuance of the policy which endeavours to keep our publication at its present standard. We must all agree with the Finance Member of the Viceroy's Council that we must cover our deficit and if we cannot cover it by means of increased revenue we must use the Geddes and Inchcape Axe and cut down the Journal, including therein the Editorial.

The present year will probably write *Finis* to the work of the Society's Mammal Survey of India, as it is unlikely that fresh funds will be forthcoming for the continuance of this enterprise. Of the value of the work that the Survey has accomplished it is unnecessary to comment—before long we hope to see the results of this unique endeavour epitomised in a new volume on the Mammals of India in the Fauna of British India Series. Two of the Society's collectors are still at work. One of them is now negotiating the Pindari Glacier under the guidance of Col. R. W. Burton, to whom our thanks are due for his continued assistance in obtaining material for the Survey and the Prince of Wales' Museum. To Major C. H. Stockley we are in like manner indebted not only for his interesting narrative of a 'Journey to Siam and Back,' but also for many valued contributions to the Society's Museum. The subject of the Survey brings us to mention that very interesting expedition which left England last February for Polynesia, *via* Madeira and the Panama Canal, on the Steam Yacht "St. George" chartered by the Expeditionary Research Association with the object of carrying out scientific research in various parts of the globe. The scientific director of the expedition is a member of this Society, Mr. James Hornell, late Director of Fisheries, Madras. Mr. Hornell will take charge of the Ethnological work, Dr. C. Crossley of Marine Zoology, and among others the party includes an Ornithologist, an Entomologist, a Botanist and a Geologist. We wish the Expeditionary Research Association every success in the enterprise and are gratified to know that a member of this Society is serving it in so honoured a capacity.

Before leaving India, Mr. Hornell sang his *nunc dimittis* in his administration report of the Madras Fisheries Department for the year 1922-23. In the report we find the results of his years of endeavour to place this department on a satisfactory basis. He writes, "In several respects the past year has proved a record; all the important Revenue sections have prospered exceedingly and I can leave the department with the knowledge that it has successfully turned the corner of adversity caused by the aftermath of the Great War. My successor will find the department fully reorganized and the lines of further progress definitely marked out so soon as the finances of the country justify renewed expansion." It must have afforded Mr. Hornell particular gratification to be able to round off his fifteen years' work in Madras with so highly satisfactory an account of the result of his stewardship. One of the last acts of Mr. Hornell was to secure for publication in the pages of this Journal a series of papers on Indian Marine fish by Dr. H. W. Fowler of the Academy of Sciences, Philadelphia. The urgent need for a revision of our knowledge on this subject has been apparent for some considerable time—the works of Francis Day are now obsolete, and the nomenclature is out of date and in many instances erroneous. Dr. Hora of the Indian Museum has for sometime been engaged in the study of fresh water fish, but the marine forms have been hitherto practically neglected, and Dr. Fowler will be doing for us a long expected and much needed work. The Society proposes to assist him with material collected in this country, and we appeal to members to help in the work. Specimens should be pickled in spirits or formaline. Particulars will be supplied to all those who signify their intention to further this project.

How long will it be before we have established here in Bombay a Department of Fisheries which is doing work parallel to that which is being done in Madras? At some future date, possibly after further costly and abortive attempts to improve our fish supplies, the urgent need for a scientific survey of the marine fauna of the western Coast will be realised. Money spent in investigations which do not immediately yield results in hard cash cause grievous heart-burning in a commercially minded community, yet times out of number investigations of this nature have formed the essential basis upon which many a remunerative and revenue earning industry has been built.

Speaking of revenue brings us to the subject of "revenue and pigs," as the Department of Agriculture, Bombay, has recently published a record



of evil doing on the part of that marauding desperado *Sus cristatus* & the Indian Wild Boar. Few people are aware of the extent of the havoc wrought to agriculture in this country by wild pigs. That the grievance is acute and calls for immediate remedy is apparent from the amazing statistics provided by the Department. In certain districts the pigs are actually ousting the villagers from their homes, and turning fertile fields into barren wastes. Figures provided by the Department give the best indication of the appalling conditions that obtain in certain areas. Witness the following tabulation of annual damage to crops:—

Konkan	..	..	..	..	8 to 10	lakhs of rupees.
Thana District	..	..	..	..	9 to 10	do.
Surat	..	..	..	..	15	do.
Deccan Canal Areas	..	..	..	..	1½	do.
Gujerat	..	..	..	..	30 per cent.	of the crop.

The direct damage to the Presidency is conservatively estimated at 70 lakhs, whilst the indirect loss runs into crores of rupees. In most districts sugar cane suffers to the extent of 50 per cent. of the crop, ground-nuts 25 per cent., rice 10 per cent. The Department of Agriculture is devising ways and means to cope with the menace. A war of extermination on a species which is among the most prolific of hoofed animals would be worse than useless. Attention must therefore be directed to the saving of the crops. This is the thorny problem with which the department is now wrestling. Fencing-in of large areas would necessarily be an exceedingly costly process, and would be impossible without liberal Government support. Suggestions which would tend in any way towards the solution of the problem would be welcome.

In connection with the slaying of the mighty boar we have to record with gratitude, that the Society has just received, on deposit, a collection of manuscripts relating to the doings of pigstickers, these being the Records of the Ahmedabad Tent Club, dating as far back as 1858. The entries include such names as "Roberts," believed to be the late Field Marshall, and the manuscript is illustrated with many spirited drawings and sketches. A perusal of these records will we are certain appeal not only to the ardent pigsticker but will also interest a much wider field. They are records of more spacious days when the earning of one's bread by the sweat of one's brow did not apply with such special force as it does to-day. The leisure of the past filled the columns of those now defunct Journals the "Asian" and the "Oriental Sporting Magazine" with lively records and observations on Sport and Natural History by a host of enthusiastic amateurs. To this Society has fallen the privilege of carrying on work which has given joy and inspiration to all who seek and find solace within that fane which is—

"Nature's Cathedral, boundless as our wonder,  
Whose quenchless lamps the sun and moon supply,  
Its choir the winds and waves, its organ thunder  
Its dome the sky."

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It is with deep regret that we record the death at Calcutta of Dr. T. N. Annandale, F.R.S., C.I.E., D.Sc., late Director of the Zoological Survey of India and Superintendent of the Indian Museum, Calcutta. Dr. Annandale's contribution to the cause of Scientific Progress in India is appreciated by all who are conversant with his work in this country.

His early demise has deprived the Zoological Survey of India, not only of its founder but also of a distinguished and capable leader.

Dr. S. W. Kemp, the Superintendent of the Zoological Survey of India, writes us:—

"I shall be obliged if you will convey to the Committee and Members of the Bombay Natural History Society the sincere thanks of myself

and my colleagues for your letter of condolence in the loss we have sustained by the sudden death of our Director Dr. N. Annandale. By his death we are deprived of a chief who had endeared himself to all his staff by his never-failing generosity and consideration for others. It is only a few years since he succeeded in placing this department on a satisfactory footing and we feel that the loss of his high scientific ability and long administrative experience is an irreparable disaster."

Dr. Annandale recently consented to serve on the Managing Committee of the Society and his loss has deprived us of the benefit of his mature experience and advice.

Our sincerest condolences are offered to the members of his family.

We hope in the next issue to have the privilege of publishing appreciation and record of Dr. Annandale's work in India.

#### FAUNA OF BRITISH INDIA.

IN the "*FAUNA OF BRITISH INDIA*" Series the further volumes which the Editor, Sir Arthur E. Shipley, with the assistance of Dr. Hugh Scott and with the sanction of the Secretary of State for India, has arranged for, are:—

Volumes on *Butterflies* (*Lycænidae* and *Hesperiidae*) by Mr. N. D. Riley : on the *Ixodidae* and *Argasidae* by Professor G. H. F. Nuttall and Mr. C. Warburton : on *Leeches* by Mr. W. A. Harding and Prof. J. Percy Moore : on the *Curculionidae* by Dr. G. A. K. Marshall : on the *Carabidae* by Mr. H. E. Andrewes : on the *Meloidae* by Mr. K. G. Blair : on the *Erotylidae* and *Endomychidae* by Mr. G. J. Arrow : on the *Culicidae* by Capt. P. J. Barraud, Lt.-Col. S. R. Christophers, and Mr. F. W. Edwards : on the *Chrysomelidae* (subfamilies *Chrysomelinae* and *Halticinae*) by Mr. S. Maulik : on the *Scolytidae* and *Platypodidae* by Lt.-Col. Winn Sampson : together with a revised edition of *Mammalia* by Mr. Martin A. C. Hinton and Mr. R. I. Pocock and of *Birds* (6 vols.) by Mr. E. C. Stuart Baker.

26 Nov. 1923.



## OBITUARY.

COLONEL CHARLES SWINHOE, M.A. (OXON.), F.L.S., F.Z.S., F.E.S.

There passed away on December 2nd last year one of the eight original members of our Society. The late Col. Swinhoe was born on August 29th, 1836 and at the age of 19 entered the Army as an Ensign in the 56th Regiment of Foot. He reached India just after the Mutiny and joined the Bombay Staff Corps, with which Corps he served until his retirement from the Army 30 years ago. He went through the Afghan War and was with Lord Roberts in Kandahar. On his retirement from the Army he settled down at Oxford, but later on moved to London, where he died.

Colonel Swinhoe was a man of many parts. A keen shikari of the old school, who had accounted for between 50 and 60 tigers; devoted to most outdoor games and sports; interested in birds and a member of the British Ornithologists Union; but it is as an Entomologist that he has attained fame and for many years he has been regarded as an expert on Lepidoptera. During his time in India he was an indefatigable collector, working chiefly in the Bombay, Poona, Mhow, and Karachi Districts and many contributions from his pen are to be found in the earlier numbers of the Journal. After his retirement he devoted the remainder of his life entirely to the study of Lepidoptera and contributed freely to the Annals and Magazine of Natural History. On the death of Frederick Moore, Col. Swinhoe was entrusted with the completion of that magnificent work on Indian Butterflies, *Lepidoptera Indica*; the portions dealing with the *Lycaenidae* (Blues), *Hesperiidae* (Skippers) and a part of the *Pieridae*, (Whites) were compiled entirely by him. The Heterocera or Moths was, however, the section of the Lepidoptera wherein Col. Swinhoe excelled; of these he had amassed a collection containing 40,000 specimens, comprising 7,000 different species and including over 400 types of new species described by him. He remained active up to the commencement of his 87th year, just prior to which he had completed "A revision of the genera of the family *Liparidae*," covering no fewer than 1,130 detailed entries.

He was well known as a lecturer on such subjects as Mimicry and was acknowledged as an expert on all matters connected with Lepidoptera by investigators of many countries. For his services to Entomology the University of Oxford conferred upon him the honorary degree of Master of Arts, and the Entomological Society of France appointed him an Honorary Member. But until some future generation throws into the scrap heap our present system of nomenclature, Col. Swinhoe's name will be preserved as the describer of many new butterflies and moths, while many others have been named after him by authors, who have wished to honour a name, that has been pre-eminent among Entomologists for many years.

## MISCELLANEOUS NOTES.

No. I.—READER'S COMMENTS ON PREVIOUS NOTES  
ARTICLES.

## PROTECTIVE COLOURATION IN WILD ANIMALS.

(Vol. XXIX, No. 2, p. 469)

I read with considerable interest the article under the above title by B. P. Tailyour in the August Number of the Journal. The principle of 'Counter-shading' to which he has been led by his observations and experiments is very little different from what the American Artist-Naturalist Abbot H. Thayer discovered in 1896. He called it the Neutralisation of Shadow. Poulton several years before him had recognised the importance of this factor for purposes of concealment in regard to two insects but for the wider generalisation credit is due to Thayer. He published a book on 'Concealing Colouration in the Animal Kingdom' (New York, 1910). I have not read this book but there are copious references in Poulton's papers from one of which the following may be extracted.

"The colours of large numbers of animals are darkest on the back, becoming gradually lighter on the sides, and passing into white on the belly. Abbot H. Thayer has suggested that this gradation obliterates the appearance of solidity, which is due to shadow. A colour-harmony, which is also essential to concealment, is produced because the back is of the same tint as the environment (*viz.*, earth), bathed in the cold blue-white of the sky, while the belly, being cold blue-white bathed in shadow and yellow earth reflections, produces the same effect. Thayer has made and presented models to the Natural History Museums of Oxford, Cambridge, and London, which support his interpretation in a very convincing manner.

"Special resemblances to twigs, upright stems, &c., are, Mr. Thayer considers, represented upon a background in which the shadow is neutralized as described above. Hence the background. *viz.*, the animal's body, disappears, while the markings upon it are alone distinctly seen.

"For ages the artist has known how to produce the appearance of solid objects standing out on his canvas, by painting in the likeness of the shadows. It has remained for this great artist-naturalist to realize the logical antithesis, and show how solid objects may be made to fade away and become ghost-like or even invisible, by painting out the shadows."

I saw the models referred to in the Entrance Hall of the Museum of Natural History, London. They were of ducks against a common back ground. One coloured as the back ground uniformly throughout and the other as in a normal bird and at a certain distance the latter one became invisible while the other was conspicuous.

It will be seen that the principle thus described and illustrated by Thayer is much the same as the one now enunciated by Mr. Tailyour. Mr. Thayer was led to this interesting generalisation from his training and experience as an artist. The credit is, therefore, all the greater to Mr. Tailyour for having arrived independently though much later at practically the same conclusion without any such training to guide him.

DEPT. OF AGRICULTURE,  
BANGALORE,

K. KUNHI KANNAN, M.A., Ph. D.

18th October 1923.



## "STRANGE" BEHAVIOUR OF A PANTHER.

(Vol. XXIX, No. 2, p. 549)

The behaviour of a panther, referred to as "strange" by Mr. Hanhart in his note in the Journal of 25th August last (Vol. XXIX, No. 2), is easily accounted for, and is, I think, not unusual. The animal was merely trying to avoid observation. It was aware that by moving it would at once attract attention, and by remaining motionless hoped to escape being seen. As we all know, it is movement in nature that attracts observation and nullifies the advantages of protective colouration, which is only protective in a state of immobility. I think the behaviour of the panther in question was not strange, but normal. No doubt many animals do escape observation by this means. I saw the same thing in a hen pheasant a few days ago, which was moving in an open stubble field. When it saw me at a distance, the bird squatted with neck extended and head flat on the ground, and did not move until I walked up to within five yards, when evidently realising that it was observed, it took to flight. While still, it was quite invisible.

An experience very similar to that related by Mr. Hanhart occurred to me some ten years ago. I was encamped in a country infested by panthers, when some Brinjara came with news that they had marked one down, and left some of their people to watch it. I rode out to the spot, and found a grassy nullah with few bushes; the panther was said to be lying under a small bush about forty yards off. From the top of the hill above, the men said they could see the animal, and attempted to point it out to me, but I could not make it out. During this time, the men continued talking, and a dog with them barked at times. I remonstrated with them, telling them not to talk or they would drive the panther away. But one of them explained to me that, on the contrary, if they ceased talking the panther would think they had gone, and would get up and make off. So long as it was made aware of their presence, it would not move, hoping thus to escape observation. It was with some difficulty and after some shouting and throwing of stones that the beast was made to break cover, and was shot.

It is for the same reason that it is advisable, when one is going to sit over a kill or a tethered goat in wait for a panther, to cause one's attendants to move off talking after the arrangements have been made, leaving one in silence and in ambush on the spot. The panther thus supposing that all the people have gone and that the coast is clear will issue forth boldly as soon as the noise has passed out of hearing.

R. G. BURTON,  
Brigr.-General.

BAFFORD GRANGE, CHARLTON KINGS,  
8th October 1923.

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No. II.—LARGE TUSKS OF INDIAN ELEPHANT (*E. MAXIMUS*).

*With a Photo.*

I enclose herewith two photos of a pair of elephant tusks which were found in the Coimbatore jungles, as I think they must nearly constitute a record for India, taking all their measurements together with their weight. The tusks were



dry, and had evidently been lying in the jungle for at least a year, and, as I understand ivory loses 5 per cent., the weight must have been very considerably more when the elephant died. The measurements and weights were most carefully taken, and were checked by two other European planters here.

Right Tusk ..	Length. 7 ft. 8 inches.	Girth $\therefore 18\frac{5}{8}$	Weight, 79 $\frac{1}{2}$ lbs.
Left Tusk ..	Do. 7 ft. 10 inches.	Do. $\therefore 19\frac{1}{4}$	Do. 82 $\frac{1}{2}$ lbs.
			Total weight 162 lbs.

Weights and measurements carefully checked by the following—

E. W. Simcock.

C. L. Napier.

C. R. T. Congreve.

C. R. T. CONGREVE.

VALPARAI, COIMBATORE,  
18th December 1923.



No. III—IN THE HAUNTS OF THE RED INDIAN WILD DOG  
(*CUON DUKHUNENSIS*).

As the dawn breaks over an Indian jungle, the glistening whiteness of a small encampment is revealed beneath the fruit-laden trees of a shady mango tope.

Near by is a small village containing about a dozen huts of very flimsy construction and principally built of bamboo. All round are parched fields which spring into life on the advent of the monsoon, and from which the villagers obtain their annual stock of rice.

This tiny hamlet, situated in the eastern corner of the Central Provinces, almost on the borders of Bastar State, is inhabited by a very uncivilised, aboriginal tribe known as the "Mariahs" or "Marie Gouds," whose intellect is akin to their dress in scantiness.

They are, however, a very willing and friendly folk, and are hard to surpass in jungle craft: the way thirty or forty of them will drive game, and particularly tiger, through difficult and broken country, up to some fixed point is quite marvellous; besides which they are gifted with extraordinary powers of tracking.

It was in this tiny camp that I found myself in May 1913, and from the look of the surrounding jungles I seemed to have found a good spot.

Also, on my way there, three miles along the road, between two nullahs which it crossed, were the going and returning "pugs" of a huge tiger, who killed one of my "baits" a few hours after my arrival, but as thereby hangs a tale and this story does not concern him, I must leave him for a while.

These jungles are situated in very broken and hilly country, full of rock-strewn, bamboo-covered ridges of granitoid gneiss, the haunts of countless spur-fowl, sloth bear, sambhur and panther.

Between the hill ranges were expansive valleys—thinly treed, and clothed with a garment of tall jungle grass, in which roamed herds of bison, swamp deer, and pig, with occasionally herds of the mighty wild buffaloes; these valleys were intersected here and there by sandy water-courses and nullahs, the haunt of tiger. Water was scarce. Here and there in the nullahs one would find a pool, and from the countless tracks around it one quickly realized how much it was frequented by all kinds of game. The surrounding country was destitute of villages, the nearest being eight miles to the south west, after which one could go some twelve miles or more in any direction without coming across any human habitation.

As the incidents I am about to relate are connected with one of the watering places near the village, a brief description of it is necessary.

A few hundred yards to the west of the village was a small sandy water course, which turned sharply to the south, and then ran parallel with a jungle road.

About half-a-mile from the village and alongside this road there still remained in the nullah a broad, shallow pool, used daily for watering the small herd of village cattle, and which at night was frequented by some half dozen panthers and various other wild animals. In addition to this, in the vicinity of the village, there were many small pools of water which had been obtained by digging deeply into the sand, and wild animals, if disturbed at the large pool on their nightly visits, would often go elsewhere in this nullah for water.

Previous to this I had often seen wild dogs without getting a shot at them, and my Punjabi Mussulman orderly knew these red brutes well by sight.

Consequently, one morning, I had no doubts about his story when he arrived breathless while I was breakfasting and told me that as he had been washing his clothes at the large pool, a pack of about twenty-five wild dogs had trotted down, and, without paying the slightest attention to him, had first of all slaked their thirst, and then had all lain down in the water with just their heads showing.



Any idea of tackling the rest of my breakfast was quickly dispensed with, and I was soon—shot gun in hand—doubling after my orderly who was carrying my spare weapon—a .256 Mannlicher. "S. G." and "B. B." were the sizes of the shot I took with me, but I was greatly handicapped by a broken gear-spring in the mechanism of the action of the left trigger, which prevented me from using the left barrel.

On arriving at the pool, which was not more than 60 feet by 30 feet in size, not a sign of a "cuon" was to be seen, and bitterly disappointed, I was about to turn away, when my orderly suggested having a look further in the jungle round the nullah.

I had hardly taken a pace forward into the scrub when tawny forms rose up from the shade of bushes and tussocks of grass, and the whole place seemed alive with wild dogs.

Having read a great deal about the shyness of these animals, I hastily fired a charge of "S.G." at the largest one, but the range was too far to use such pellets with effect which only scattered and did no damage.

Quickly reloading, a second shot was more successful, and bowled over a fair-sized bitch.

Upon this second discharge a huge beast jumped out of the nullah and passing close by me as I crammed in a fresh cartridge, halted a few yards distant presenting an easy target.

Unfortunately I had loaded with lethal bullet, and a snapshot at him proved in vain, for in my eagerness I jerked the trigger and caused the muzzle of the gun to bob down, with the result that the bullet struck the ground beneath the animal's stomach.

It was then that I noticed the curious whistling noise that these animals make when alarmed, and I could hear it all around me in the jungle and on the slopes of an adjacent hill.

Besides this I was rather surprised at the boldness of these "Red Dog" which, even after three shots, showed no inclination to hurry their departure or move very far away.

Consequently, I sent my orderly to round them up and drive them back again towards me from the hill where they had taken refuge.

This manoeuvre was very nearly successful, but the "cuons" had just enough start to get ahead of me and making a detour they passed across the road at the village end of the pool and began making their way up the slopes of another scrub-covered hill.

Meanwhile I had noticed three "Red Dog" lying in the pool, and missed one badly with a snapshot from the Mannlicher. Then as the dogs were climbing the northern slopes of the hill, I ran up from the south side, and on ascending a ridge near the top and looking over, I found myself face to face with a large dog which I dropped, and which curiously enough turned out to be in miserable condition. He had a mangy coat, was thin and emaciated in form, and had diseased teeth. Why he had been allowed to live, let alone remain in the pack, I cannot imagine, and I was sorry I had destroyed him, as he might have spread his ailments through the pack with fatal consequences.

By this time it must have been 10-30 and as I did not feel inclined to resume the chase over the hills at that hour, when the heat was distinctly unpleasant, I gave orders to the forest guard to make arrangements for the erection of a well-screened *machan* in a low bushy tree growing at the edge of the water.

In about two hours time it was ready, and in the meantime I had returned to camp.

When my orderly came to call me, he said that the parties of wild dogs had been down to drink and bathe while they were at work.

Consequently, I was hardly surprised on arriving at the pool to see three tawny heads sticking out of the water behind a rock at the farther end.



A charge of "B. B." beyond peppering them did little damage, but I managed by running to cut off one from the hill it was making for, and bowled it over with a lucky shot—not quite good enough however—as he got up and limped off on three legs in absolute ignorance of the direction of his aggressor.

Unfortunately, he saw me a few minutes later, and in spite of his wound was off at a great pace and soon was lost to sight in the tall jungle grass and thick scrub.

After this disappointment and strenuous chase, I returned—hot and exhausted—to the *machan*, but for a long time there were no further signs of the "cuons."

About 3-45 however, a movement to one side attracted my attention, and I observed five reddish forms stealing along over the slippery, black rocks at the north end of the pool. But what a change from the bold, devil-may-care-attitude previously adopted by these animals. Now they come slinking cautiously along, ears pricked up and attentive for the least sound, eyes searching in every direction, now and then a pause, and last of all a careful look round as they reached the edge of the inviting pool. I looked again, this time along the sights of my gun; all I could see were five tawny heads grouped close together sticking out of the water. Bang! Five writhing forms are down in the shallow pool, but such a bag is too good to be true, especially with a single barrel; and almost immediately, two of them, only slightly peppered, jump up and scamper away, while a third, in spite of a broken shoulder, makes off at a great pace.

The remaining two, however, are powerless to get away, and a couple of bullets from a .22 bore rifle speedily put an end to their sufferings. Not so bad after all, but what a triumph it would have been if I had had a second barrel to follow up my first shot.

After this, I left the pool alone for the day and early next morning, as usual, went for a long ramble in the jungle, but I had left a watcher at the pool, who, on my return reported that he had seen three wild dogs. Accordingly, later on in the day I again took up my position in the hide, and about midday the member of the luckless party of five of the previous day, who had retired with a broken shoulder came limping along and crept towards the pool with the utmost wariness.

Although he did not detect me, he was very suspicious. As he paused at the edge of the pool, he was struck by a charge of "B.B." and rolled over into the water, out of which he scrambled on to the hill side, and fell dead after going twenty paces.

The same evening I was sitting over a goat for a panther when two wild dogs came down to drink at dusk. I had a shot at them, but both got away without serious injury, although knocked over and well peppered by the charge.

The last glimpse I had of the remnants of the pack was on the following morning as I passed the pool shortly after dawn. For I observed half-a-dozen reddish hued forms stealing away through the clumps of bamboos which grew in profusion on the slopes of the hill to the east of the watering place.

In passing from this subject I can only add my regrets that I had not doubled or even trebled my bag as the red dogs are an absolute curse in the jungle, and they are the most ruthless destroyers of game that exist. So bad are they that in the Central Provinces a reward of Rs. 15 each is given for wild dog, while in the United Provinces, both the Civil and Forest authorities give rewards for their destruction.

One rarely gets such opportunities with a pack of "cuons" and if only I could have followed up every shot with a second barrel, I would have inflicted infinitely more damage on the pack.

C. R. S. PITMAN.

KENYA COLONY, EAST AFRICA,  
12th September 1923.



#### No. IV.—A NOVEL METHOD OF SHOOTING BLACK BEAR IN THE "GALIS".

Finding myself at Nathia Gali in the Murree Hills at the end of June 1912 with a few days to spare on my hands, I looked about for something to shoot. Having ascertained that at Dunga Gali,  $2\frac{1}{2}$  miles away, there was a shikari of sorts, I sent for him and discussed the prospects of bagging a bear within the next week or so.

I was shown a long and well-wooded nullah which ran down some thousands of feet to the Jhelum River, and was told that bear would certainly be found there, but were not likely to be obtained unless I cared to kill an ox and leave the carcass in a certain favourable spot, known to the shikari, some way down the khud.

Having purchased the bullock, I left the whole of the bandobast in the hands of the shikari who proceeded to tell me that Major . . . . . last year had managed to bag no less than four bears over oxen he had killed, and placed in the same spot where mine would be.

Pleased at the prospect of a new form of shikar I returned to my headquarters and waited for news. On June 24th the carcass was placed in the forest, and that night a bear came round and inspected it; but did not summon up enough courage to tackle it until the night of 26th June.

Being informed of this, I determined to sit up over the carcass the next night.

I arrived at the spot about 6 p.m. and saw that the head and one of the shoulders had disappeared and that a large portion of the neck had been eaten.

At that time there was a bright moon and at 9 o'clock I heard a bear below on the khud side but he had evidently got hold of a shoulder or the head for I was entertained for a long time with the sounds of crunching and cracking of bones, and then when he did start off for the carcass he must have winded us from the slight breeze which was blowing, and moved off again without showing himself. Later, I heard another bear moving about, accompanied by a couple of cubs, but they also eventually went off down the nullah.

The next night saw me again in the *machan* and on my way to it I came across the fresh and unmistakable traces of a panther.

He had evidently inspected the carcass that evening, but as he was not likely to touch the putrid remains unless very hard pressed for a meal, I was rather anxious to see if he would turn up that night.

And turn up he did, for at 8-30 that evening I detected a slight movement, and heard the snapping of a few twigs as he took up his position beneath an adjacent bush, and broke the stillness of the night from time to time with an occasional rasping sigh.

I wondered what he intended. Was he wanting a meal, and having winded us, was awaiting further developments, or did he think that the old bear with cubs would come along, and that while she was busily engaged at her nasty feed he might have a chance of abducting one of the plump little youngsters?

At any rate there he sat and about an hour later an old bear came bustling down the hill from above me straight towards the carcass.

But no! he winds the panther and with a frightened "woof" crashes away down into the rocky nullah. Soon afterwards "Spots" tires of his task and silently wends his way up the hill, and another profitless vigil ends with the chilly dawn.

I told the shikari that I should not sit up that night, but to cut up the remains and strew the surrounding forest with tempting morsels.

This apparently had the desired effect for the next day I heard that nearly the whole of the ox had been eaten and that the panther had again been in the vicinity. The moon was now rising later and later and, on arriving at the *machan* that night, I quickly realised that it would probably be my last chance.

Soon after I took up my position on the springy platform of fir branches I heard a couple of martens fighting in a blasted pine which towered above me.



As I waited and watched, I pondered over the chances of getting a shot that night, and as the hours sped by I began to give up all hope.

But it was still early and at 10-30 I heard the welcome shuffling sound close by and below me.

Holding my breath I waited ; I dare not raise my hand to keep off the myriads of mosquitoes which took this opportunity of launching a determined attack on me.

A branch cracked, some leaves rustled, and my aching limbs had to be eased : the shikari scowled at me, but to no purpose : I had to move, but still the bear shuffled on. A sound of bones being cracked showed me that he was for the time being occupied with morsels previously dragged away from the carcase.

When he had been shuffling around for nearly an hour, he suddenly bestirred himself, and with the utmost caution approached the open space where lay the few remaining pieces of bullock.

A final crash as he burst through the thick bushes, and I perceived a black form waddle towards the carcase and sniff it.

Unlike the semi-blind and almost deaf Sloth Bear of the Indian Peninsula, these Himalayan Bears are possessed of all their faculties.

Consequently I drew a bead on him at once, and waited till he should offer a broadside shot.

As I watched, he turned towards me and presented quite a good target and the contents of my first barrel, loaded with lethal bullet caught him in the shoulder, and bowled him over. The second barrel unfortunately was not so successful as he lay kicking on his back, and before I could reload, he had picked himself up and flung himself over the steep khud, where I heard him crashing down through the bushes and undergrowth into the nullah below.

It was impossible to follow him up at once, and I had to content myself till dawn with the thought that he was badly wounded and could not go far.

But all kinds of bear are possessed of wonderful vitality and I was doomed to disappointment.

When light came the trail was quickly picked up and from the marks and blood it was at once evident that a badly smashed shoulder was the damage.

For over two miles we followed these tracks, and then found ourselves utterly at fault when we arrived at a small mountain torrent.

Casting round in circles was of no avail, for the luckless bear had made good his escape.

In all probability he had washed his wound in the water, staunched the flow of blood, and then plastered it with leaves and mud, and so got clear away, without leaving a trace behind him.

C. R. S. PITMAN.

KENYA COLONY, EAST AFRICA,  
14th November 1923.

#### NO. V.—BLACK-BUCK AND JACKAL.

An incident of interest which I saw a short while ago, was as follows:—I was after Black Buck in fairly open country near Nabha when I saw a buck being chased by a single jackal. The buck must have had something the matter with its leg, although it ran very fast, for the jackal succeeded in catching it up and pulled it down three times single handed. It always went for the back part of the stomach and eventually disabled it. I went up and shot the jackal which was quite a small one, and finished off the buck which could not move. I could not find any visible signs of any previous injury on the Black Buck which would account for its lameness.

NABHA STATE, PUNJAB,  
26th November 1923.

L. G. W. HAMBER, CAPT.,  
1/1st K. G. O. Gurkha Rifles.

No. VI.—MALFORMED HORNS IN THE CHEETAL (*AXIS AXIS*).  
(With a photo.)



No. 2.

No. 1.

No. 2.

No. 3.

No. 1. Malformed horns of the cheetal (*A. axis*).

No. 2. 2. Picked up antlers of the same animal shed in the preceding year.

No. 3. Normal horns of the cheetal for comparison.

I send you for publication, a photograph of a freak of nature in the way of a pair of Cheetal (Spotted Deer) horns.

I first observed the stag carrying these about the end of April 1921 when I was shooting in little visited shrub jungle in the hope of securing one of the good heads I knew were there.

I shot a stag in very open jungle and the report of my rifle put up 7 hinds and a stag (this freak). The stag ran to my left and stood on a ridge barely 100 yards away and I could not but immediately notice the extraordinary horns. He gave me a splendid shot (broad-side), but I missed him and later discovered that the second leaf of the backsight was up. I promptly followed the herd and saw them crossing a piece of open for another patch of jungle and emptied my magazine on the stag but with no result. I continued following and came across the stag who had his horns badly entangled in a big "Karonda" bush and was making frantic efforts to get loose, but before I could get round for a shot he disentangled himself and disappeared, and though I searched the jungle thoroughly in a scorching sun all day, I did not see him again on this occasion.

On another visit to the same jungle I did not come across this stag but on a third occasion I saw him again and this at the end of the day when I had given up all hopes as I had worked hard in a thorough search of the surrounding jungles.

I was returning to my Headquarters through the jungle, when I saw a couple of hinds with a good stag looking at me and shot the stag, and when they made off I discovered to my chagrin that the object of my search was in the herd. I took a running snap shot but another Cheetal (female) intercepted and so I again



lost the trophy ; the possession of which had now become an ambition if not an obsession. Unfortunately, I did not get an opportunity to go out again.

In August I sent my Shikari out to see if the stag was still there and report on the condition of his horns and he brought in the horns numbered (2) the photograph of which I send, picked up by a grazier not far apart.

From then onward I had him very closely watched to see if he would grow freak horns again which he did and in April 1922, having been informed that his horns were no longer in velvet, I went out and shot him with the horns numbered (1).

Quite apart from being an abnormal freak, it clearly establishes that freak horns are permanent and not only confined to one set. I may mention here that beyond this freak, the stag had no other visible defect about him which I could detect.

The horns numbered (3) are those of a natural head, ( $36\frac{3}{4}$ " ) in order to show the vast contrast.

HOSHANGABAD, C.P.,  
November 1922.

B. A. PARR,  
Inspector of Police.

#### No. VII.—SOUTHERN RANGE OF THE MALLARD (*ANAS BOSCAS*).

A Mallard was shot by Mr. Borrisow near Taluja (Panwell, Bombay) on November 17th. It was a male bird but the curl of the tail feathers was only just beginning. The bird seemed in good condition but allowed us to get very close before rising, which was all the more surprising because we had been shooting snipe within 50 yards of the bunch of reeds from which we flushed him. Mr. Borrisow shot the same ground a week later and saw another Mallard.

J. R. ABERCROMBIE.

BOMBAY, 8th January 1924.

A drake Mallard, a solitary bird, was shot on Xmas day at Palam tank, about 5 miles from Bulsar. This I believe is further south than Stuart Baker records its occurrence.

I obtained a solitary drake Mallard about a week earlier at Maroli, 30 miles from here, on the same tank where Mr. Ball of the B. B. & C. I. Railway shot one a year ago.

T. F. G. SHEPHARD.

BULSAR,  
B. B. & C. I. RAILWAY,  
27th December 1923.

Stuart Baker's book on Indian Birds does not record the "Mallard Duck" in this part of the world. I shot one at Pali (35 miles from Jodhpur) on Sunday, the 16th instant. It may be of interest.

MAJOR-GENL. H. D. WATSON.

JODHPUR,  
18th December 1923.

#### No. VIII.—NEST OF MRS. GOULD'S YELLOW-BACKED SUNBIRD (*ÆTHOPYGA GOULDIÆ*).

I obtained the nest and eggs of this bird in April 1923 and later in the year I showed the eggs to Mr. Stuart Baker who kindly fixed their identity for me. As I was unable to find any description of the nest one may perhaps be useful. On my describing it, Mr. Stuart Baker showed me a painting which left no doubt about it.

The nest is pear-shaped and was suspended from the end of a stem of wild raspberry and beneath the two last leaves on the stem. It was composed entirely of cotton silk or vegetable down. The whiteness of this material showing above this stem would attract attention and to conceal it the bird had fixed green creeping moss over it of the same shade as the raspberry leaf. This green creeping moss was also used like filigree work over the body of the nest to keep it together. There was only a suggestion of a porch over the entrance hole which was  $\frac{2}{3}$  of the way up. The material being so flimsy the bird had herring-boned the lower edge of the entrance hole with the same green moss doubling it over the edge so as to form a sharp firm edge. The eggs were typical *Æthopyga*, spotted with greeny brown principally at the larger end where they formed a thick circle, they measured .65 by .48 mm.

S. M. ROBINSON, M.B.O.U.

No. IX.—NESTING OF WALDEN'S YELLOW-BACKED SUNBIRD  
(*ÆTHOPYGA SANGUINIPECTA*).

On seeing Mr. Stuart Baker at home I told him I had obtained this bird and its nest and eggs at Thandaung in the Karen Hills east of Toungoo. He said the nest and eggs had never previously been obtained and I apologize for not having sent in a description before. I obtained them on 20th April 1923.

*Nest*.—Pear-shaped entrance  $\frac{2}{3}$  of the way up with only a bare suggestion of a porch. It was composed of dried grass stems lined heavily with silky white grass down and decorated outside all over with chips of dealwood, bits of dead bamboo and bamboo leaf. It was suspended from the end of a wild raspberry stem. The eggs are dull white spotted all over with greeny brown spots which are thickest at the larger end where they run into each other and form a circle. The eggs measure .69 by .48 mm.

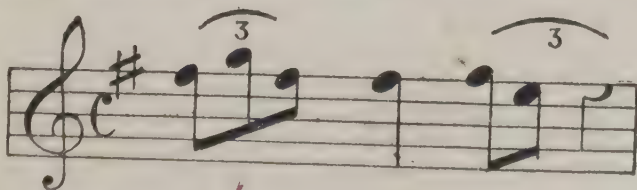
S. M. ROBINSON, M.B.O.U.

January 1924.

No. X.—NIDIFICATION OF THE WESTERN SPOTTED  
BABBLER. (*P. RUFICEPS JONESI*)

In the Fauna of British India—Birds—Vol. I (second edition) at page 242 under *Pellorneum ruficeps jonesi* (the Western Spotted Babbler) the note occurs "Nidification unknown." As I have found several nests of this babbler in the Dehra Dun, where it is a common bird, I write to record the fact.

This Babbler is found throughout the better wooded portions of the Dun. It is specially numerous in the wooded ravines and in the tea gardens close to Dehra itself. The male bird has a very pretty short song of six clear notes, frequently repeated which may be musically represented as follows:—



The birds are shy and spend most of their time moving gently about among dead leaves on the ground. They occur singly or in pairs and are not gregarious. Nidification commences early in April.

On April 19th, 1916, I found a nest at the foot of a tea bush (Kowlagarh Tea Estate) close to Dehra. It contained 4 incubated eggs.

On April 24th of the same year I observed a pair of birds building their nest on the steep bank of a ravine. The nest was on the grounds, well concealed among dead leaves.



The same day in another ravine I came on a brood of young birds which had only recently left the nest. The mother bird appeared on the scene and came within two or three feet of me as I sat near the nest with one young bird in my hand. She moved round me almost like a mouse, but with wings expanded and feigning a wound.

Nests were all very loosely constructed and domed with a large lateral entrance. The nests, as well as the eggs, much resemble those of *P. ruficeps ruficeps* subsequently found by me near Pachmarhi in the Central Provinces. Unfortunately I cannot give detailed descriptions of the eggs with measurements as I have not got the eggs by me.

RAWALPINDI,  
3rd February 1924.

B. B. OSMASTON, I.F.S.

#### No. XI.—MIGRATION OF EAGLES.

On the 9th of November 1923 I was at a place called Jathingri in the Mandi State, about 70 miles east of Dharmasala, and witnessed what could only be a regular migration of eagles. At about 3 p.m. I noticed four birds passing over the State bungalow at intervals of about a minute or two each. Later on I went down the spur in an easterly direction and again noticed birds passing in the same direction at short intervals. All came from the same direction and followed exactly the same line of flight. I went along the ridge for a couple of miles or so and took up a position on a point where the spur was quite open and overlooked a small village and fields, and watched very carefully each bird as it passed me. Occasionally two came very close together but for the most part they followed each other at intervals varying from one to four or five minutes. Each succeeding one followed its predecessor on practically an exact alignment. Each passed me on a line about 15 yards to my right as I sat and some 100 yards above me. Every bird flew with wings about quarter flexed as though breasting a strong wind and with tail widely spread. I had shot a Kalij pheasant and a chikor on my way down and tied each at the end of a long string and threw them out in opposite directions, and while well concealed myself kept on tugging at the strings and moving the two birds as I saw an eagle approach. They took not the slightest notice though they could not have helped seeing them. A sparrow hawk came down and bound to the chikor and I felt certain that she would attract an eagle, as any smaller bird of prey with a bird in its talons has an irresistible attraction for any of the eagle tribe. Two passed overhead while the sparrow hawk struggled with the chikor which was being pulled over rough ground at the time. The first took no notice whatever, but the second showed a small amount of interest, as I distinctly saw the head turn and it kept its eye on the hawk and the chikor, even after it had passed well over them, but it did not check its flight in the smallest degree and followed steadily in the wake of the others.

I did not count them but quite 40 birds must have gone over from the time I left the bungalow until nearly sunset.

With but two or three exceptions every bird appeared to be very dark in colour, and the only one that came directly over me was quite black and might have been taken for a Black Eagle (*I. malayensis*) except for the typical short tail of the true Aquila and the heavier flight with wings held in a line with the body. The two or three light coloured birds I at once put down as young Imperial (*A. heliaca*) in the lineated plumage but the dark birds defeated me entirely. Unfortunately they passed between the sun and me so just when I could have seen them best the underside of the plumage was in deep shadow.

I looked hard for any sign of white on the head or the tail bar of the typical Imperial but could not definitely make it out, owing perhaps to the position of the sun. The flight looked very much that of the Spotted Eagle (*A. maculata*), especially on account of the wide spread tail, a characteristic of the latter.

but in that case the light coloured wing patch would have been in evidence in at least some of the birds. Not one of them came within even a very long shot or I should have tried to shoot it and make sure of the species.

The following morning I left Jathingri for Dharmsala and kept an eye open for some sign of the birds I had seen the day before but only met with two during the whole day and both of these were typical Steppe Eagles (*A. bifasciata*).

The birds must have been the Imperial (*A. heliaca*) though I could not be sure of the fact. That they were true *Aquila* I have not the smallest doubt and the very dark colouring at once eliminates all the species of that genus save *chrysaetus*, *heliaca* and *maculata*. The flight and longer tail of the former at once puts him out of count and leaves us with the two latter. As *maculata* is not a migrant and distinctly uncommon in the hills, I cannot help thinking it was a migration flight of the Imperial (*A. heliaca*) that I witnessed. Of course the evidence is not good enough for a definite record, but is certainly in favour of the last named species.

I had seen one or two Imperials around the station previous to that date and I have not seen very many more since, perhaps a dozen in all, though Steppe Eagles are now fairly numerous.

Hume in his Rough Notes (p. 146) quotes, Capt. Hutton assaying that he has witnessed great flocks of *A. bifasciata* passing Mussoorie during their autumn migration and if any of our members, who have seen similar sights, would be so good as to send in a record for the Journal some very interesting data might be collected. The direction of flight was approximately E. N. E. to W. S. W.

DHARMSALA CANTT.  
KANGRA DISTRICT, PUNJAB.  
November 20th, 1923.

C. H. DONALD, F.Z.S., M.B.O.U.

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No. XII.—WIRE NESTS.



DOVE'S NEST MADE OF WIRE.



During the Great War a number of Germans were interned in the Wellesley Barracks (Old British Infantry Lines) at Ahmednagar.

The Barracks were then surrounded by the usual high barbed wire fence.

In 1921 this fence was dismantled and the materials sent to Bellary for the Moplah Prisoners Camp there. The small fragments of binding wire were left lying on the ground.

In the Autumn of 1923, during the Military reliefs, owing to the incoming regiment arriving some months before the departure of the outgoing one, the Wellesley Barracks had to be temporarily occupied, and when they were being repaired, it was found that the local doves had been making their nests of the wire cuttings. The nest is usually very well and closely woven with considerable ingenuity, and the birds must have amazing strength of beak to bend the wire.

There is usually a very thin filling of dry grass and down on the inside.

Sixty-seven of these nests were taken out of one Barrack alone.

POONA,	W. P. PAKENHAM WALSH,
	MAJOR, R. E.,
10th November 1923.	Asstt. Commanding Royal Engineer, Poona.

Wire is often used in nest construction by crows and kites. There is the classic instance of a pair of crows who built up a home with gold and silver spectacle rims, stolen from a local firm of oculists.—EDS.

#### NO. XIII.—THE INCUBATION PERIOD OF BULBUL'S EGGS.

There is hardly any definite record regarding the period of incubation for Bulbul's eggs. Field observation in this respect does not exist. Oates, in Hume's "Nests and Eggs" makes no mention of it. Two contributions, however, one by Mr. Teschemaker and the other by Dr. Amsler, in the *Avicultural Magazine* (third series, Vols. I and II,) supply us with aviary notes on this point. But the conclusions therein seem to be vitiated by imperfect records and defective calculation, and I should like to examine the two notes before I put down my own observations.

To fix the incubation period of eggs correctly we should first of all remember one thing. There are some birds—game birds and domestic fowls for example—that lay the full complement of eggs before they begin to sit. But the majority of birds begin to sit as soon as the first egg is laid. It may be that many do not sit as closely on one or two eggs as when the full clutch has been laid. Even in that case some amount of incubation occurs and this has to be taken count of in determining the period of incubation. Those who keep canaries know full well that these birds begin to sit as soon as the first egg is laid. So that those who want to ensure simultaneous birth usually employ dummy eggs until the full clutch is complete.

Two eggs are not laid simultaneously. When one is laid some time must elapse before another appears. If the intervening period be 24 hours, then the incubation of the first egg begins so much earlier. The result naturally is that the first egg hatches out one day ahead of the second and so on. All the chicks do not appear simultaneously; they cannot, simply because their incubation does not begin together. Sometimes, of course, two chicks may be found to have been hatched out on the same day. But in such cases also, there is always a difference of a few hours in their birth which escapes our notice. In determining the period of incubation, one has to count from the date when an egg is laid to the date when that particular one is hatched. Both Dr. Amsler and Mr. Teschemaker suppose that Bulbuls begin incubation with three eggs, as if the birds think one or two eggs too small a number for such an important task!

Of the five broods raised by his Bulbuls (*Otocompsa emeria*), Mr. Teschemaker kept record of one case only. Even in this one case the eggs hatched out—to quote his own words—“in the unusually short period of nine days.” He says, “Once more three eggs were laid and incubation commenced on the 14th July. . . . . Two young hatched out on the 23rd.” It may be asked, when were the three eggs laid—how long before “incubation commenced on the 23rd?” Without the dates when each egg was laid, we cannot fix the period of incubation. We do not believe that the eggs hatched out after nine days’ incubation. Even during a heat-wave in India, the eggs of Bulbuls require more than nine days’ incubation. Mr. Teschemaker evidently made some mistake.

Dr. Amsler’s records are more numerous but they are alike inconclusive. His pair of Bulbuls—they too were *Otocompsa emeria*—raised four broods in one season. The periods of incubation were, “fourteen days in the case of the first and last, and ten days in the case of the second and third nests.” From this record we cannot say what is the ‘normal’ period of incubation for Bulbuls’ eggs. Let us examine his records. The very first case would show that his method of calculation was wrong.

“The hen laid her first egg on the 25th (May). She started sitting on three eggs and laid a fourth egg on the 28th. She hatched out her first and only chick on the 9th June. One egg had disappeared, one turned out to be clear and the fourth a dead chick.”

The above statement shows that the bird does not wait for the completion of a clutch before she decides to brood. Dr. Amsler might have noticed it to sit closely on three eggs but it is possible—and natural—that the bird commenced sitting even on the 25th when the first egg was laid. Of this case Dr. Amsler says that the period of incubation was fourteen days. But how does he calculate it? We may assume from his account that the bird laid one egg each day on the 25th, 26th and 27th and that she began sitting on the 27th. He says the chick appeared on the 9th June. Leaving out the 9th June, the period of incubation, we get, is—from the 27th May to 8th June—*thirteen* days and not *fourteen*. Even this period cannot be definitely stated to be the incubation period for the egg that hatched out. Which egg was it that hatched out on the 9th June? Between 25th and 28th May four eggs were laid. The doctor does not appear to have marked the eggs as each was laid, which alone would have ensured accurate calculation. Who can say that the chick in the above case did not come out of the fourth egg which was laid on the 28th? In that case the period of incubation would become twelve days.

Let us now consider one of those cases in which the period of incubation was ten days according to Dr. Amsler. That was the period for the second and third nests. This is what he says of the third nest. “On July 31st, the hen was again sitting on three eggs, which all hatched out on August 11th and 12th.” The very fact that they were hatched out on different dates shows that their incubation also began on different days, otherwise they would have come out on the same day. This point escaped his notice. In the above case, evidently he counts the first ten days of August and puts that period down as the incubation period. But why should he leave out the 31st July when, he says, the bird began to sit? Does not incubation begin as soon as the bird begins sitting? And why should he leave out of count the 11th of August for the eggs from which the chick appeared on the 12th. The young which was hatched out on the 12th was incubated up to the 11th. From the 31st July to the 11th August it is twelve days. The eggs that were hatched on the 11th were incubated up to the 10th; the period would be, from the 31st July, eleven days. Yet Dr. Amsler makes it out to be 10 days! Certainly, this sort of calculation is defective, if not arbitrary.

I shall now give my own observations. A pair of White-eared Bulbuls (*Molpastes leucotis*), in my aviary, nested four times. Their first clutch consisted of three eggs on which the hen sat and sat for three weeks when I removed them



and found them to be clear ones. Immediately after, they built another nest in quite a large basket, full of straw which I had hung up for the use of a pair of White Doves. In this straw the Bulbuls inserted a very neat and compact cup of coir-fibres. I might mention, *en passant*, that they were not at all shy at this time and quite frequently came close to me to take the coir-fibres which I would throw to them, sometimes even accepting them from my hands. Between the 18th and 20th April the hen laid three eggs, one on each day. On the 30th April, I looked in but found no young. On the 1st May I could not inspect the aviary. On the 2nd I discovered two chicks. The egg laid on the 18th proved to be clear. The egg laid on the 19th probably hatched out on the 1st May—the day when I failed to look in, and the egg laid on the 20th hatched out on the 2nd. This makes the period of incubation 12 days. That this is the period of incubation is more convincingly proved by the more accurately kept records of the subsequent two nests which I give below. Of the next two nests I kept exact records, and the reader will find a remarkable coincidence in their dates. I should mention here that I missed the nestlings of the second nest a few days after their birth.

After repairing the same nest, the hen again laid an egg on the 17th June. On the 18th there was another and on the 19th yet another. No more eggs were laid. On the 29th June the first young hatched. Another young came out on the next day and the third egg became addled. Here the period of incubation was exactly twelve days. Going into the aviary one morning, I found a cock Dhayal most enthusiastically trying to breakfast on a young Bulbul. My entrance drove him off and I took up the half-dead thing to restore it to its nest, which I found to be empty. On looking round I discovered the other chick in a corner, pecked out of life. The cause of the disappearance of the first batch of Bulbul nestlings now became apparent to me and I removed the Dhayals to another compartment. It was well that I did so, for the next batch of nestlings lived and thrived and are now quite a healthy and lively pair of inmates of my aviary.

After the above disaster, the Bulbuls left the basket and built a nest in a German Roller Canary cage. On the 17th July, the first egg of the fourth clutch was laid. On the 18th there was a second and on the 19th a third. Again on the 29th the first egg hatched out. Two other nestlings followed consecutively on the next two days. A comparison of the dates of the last nest and this one reveals a remarkable coincidence. The third and the fourth nest, therefore, definitely settle for us the period of incubation. According to Dr. Amsler the period was 14 days in two instances and 10 in the other two of the four nests made by the same pair of birds. In the case of my birds I found no variation on three successive occasions. Dr. Amsler's bird laid four eggs on three occasions and three on one. But my bird kept on to three eggs every time.

Now I shall cite an example from Nature. In my country-house at Agarpara seven miles from Calcutta, I discovered, in a bush, a nest of the Bengal Red-Whiskered Bulbul (*Otocompsa emeria*) on the 15th April last, with one egg in it. On the 17th, there were three eggs in it. On the 28th April there were three nestlings in it. Counting from the date the last egg was laid—the 17th—to the date when the last young appeared (the 28th) the period of incubation is eleven days, a day less than the time required by the birds in my aviary. But I must mention that at this time a heat-wave was passing over the country, the maximum temperature recorded in the shade having been 106°F. The normal period, of incubation for the eggs of Bulbuls is, according to my observations, *twelve* days.

SATYA CHURN LAW,  
M. A., F.Z.S., M.B.O.U.

CALCUTTA, 5th January 1924.

No. XIV.—A NOTE ON THE WHITE-BELLIED SEA-EAGLE  
(*HALIAETUS LEUCOGASTER*).

In the Fauna of British India (Vol. III, p. 368), Blanford quotes Legge and says of *Haliaetus leucogaster*, "legs and feet whitish." Jerdon describes them as "dirty white." During my stay at Vizagapatam last year, I had, for over two months, a pair of the White-bellied Sea-Eagles under observation. I noticed that the legs and feet were of a pale brick-red colour; even the feathers on the upper tarsus were tinged with the same colour. The Calcutta Museum possesses two specimens of these birds one of which has its legs of a reddish colour. Legge says that the legs and feet of the unfledged nestling are fleshy white but the yearling has its legs as in old birds. That neither of the two birds I saw was very young is indicated by their tails which were black at the base and white at the terminal, the position of the tail colours being the reverse in young birds. It would be interesting to know whether young birds have, at any stage of their life, reddish legs and feet which gradually change into dirty white.

One evening in October, the peculiar clanging call of the birds attracted my attention. I traced them to a tree—a stone's throw from my bungalow—that towered over its neighbours. In the very topmost branch—a dry, leafless one—the birds were sitting, occasionally shifting their position and uttering their loud, far-reaching cry. Evidently, they were retiring for the night. Every evening I used to notice them there and at roosting time they would become very noisy.

In the morning the birds would leave the shore and sweep far out over the sea, occasionally making a straight dive downwards with lightning rapidity to bear away, from the surface of the blue water below, a fish or a sea-snake. Snakes seem to be a very favourite food with them and they have a special knack of fishing up these reptiles from the troubled billows. Towards mid-day, they would return inland and, rising to an enormous height, soar majestically in circles with motionless wings. Looked at from beneath, their white belly contrasted well with the black of the wings and tail, the black of each appearing to run into the other. In this position they might easily be mistaken for vultures, but for their call which were frequently indulged in. Another pair of the same species used to join them at such times. This pair, I discovered, had their home in the hills that enclose the Valley Gardens behind the Dolphin's Nose. The four of them used to be very noisy. Their *quang quang quang-a-quang* notes coming, as they did, from a height of at least eight or nine hundred feet, would recall to one the collective voice of a flock of geese. At noon I invariably found the pair near my residence silently perched on the top of some giant tree, lost in a mid-day siesta. But when the sun had crossed the meridian, they would become active again. I did not find them to be very shy; they allowed me not only to approach up to the tree on which they were sitting, but gave me considerable time to scan them well with my field-glass.

S. C. LAW, M.A., F.Z.S., M.B.O.U.

CALCUTTA, 6th February, 1924.

No. XV.—FLIGHTING ON A DELHI JHEEL.

This is one of a series of incidents that occurred to me at Xmas 1923 and is presented simply with the object of obtaining the solution to a problem of duck movement of some interest to those who shoot discriminately, and whose larder is designed to receive only the best that nature can provide. It concerns primarily the Pintail and unavoidably a variety of other duck which crossed the sunset to their undoing.

My venue was a jheel; let that be sufficient—else may the place next year be a seething mass of sportsmen of keenness unqualified and precocity outrageous.



It lay North and South, in length 600 yards, in breadth 100 yards, in depth 6 inches shelving gradually to 2 feet in the centre where the sedge and grasses yielded to disclose two handsome stretches of open water. It is on one side of these stretches that the guns are finally posted to await the duck which aim for and settle in the open before paddling silently to the shallower feeding stretches at the edge. The jheel was surrounded by a fringe of full grown sugar-cane.

Follow then the attention of the guns as they watch the last rim of the sun disappear beneath the horizon and as they regard the clouds collected at its point of departure with considerable disfavour. They value each precious minute of the time during which the duck will come and they grudge even the clouds their marvellous colourations and conformations when such may seem likely to curtail it. Within a few minutes the ball opens with a *battue* at flights of Brahminy quartering the ray-striped sky with their discordant notes in search of food and safety. They flew too high even for No. 2 shot and passed apparently unscathed through patterns of S. G.

It was decided now that the guns should move out from the sheltering cane to patches of dry land at the sides of the open water furthest from the sunset to await the fighting. In due course the duck came in their whistling tumble from the sky and the night rang with the sound of repeated shots. Alternate explosions and the scutter of rising duck, which had flown in unseen, intermingled with the whistle of newcomers and the occasional splash of a dropped bird is the best description I can give of moments which remain a confused turmoil in my memory. One was continually whirling round to a new sound, straining one's eyes to an object that defeated them, and finally—silence. Night had fallen, the duck had settled and there remained only the collection and classification of the bag; this latter was achieved by the light of motor lamps and it is herein lies the problem. Fifty per cent. of the bag was composed of that delectable duck the Pintail. On the particular occasion of which I write the remainder were:—1 shoveller, 2 widgeon, 1 common pochard, 1 female of the red-crested pochard. On subsequent occasions also Pintail formed the greater proportion of the total, whereas on other jheels under same conditions not a Pintail was obtained. Do the different species of duck utilize certain water as of habit developed immediately upon arrival and carried through either until the food supply ceases, or the water becomes unsafe and unsatisfactory? Or does the explanation of this curious segregation of species lie in the fact that the different ducks require different food and conditions of enjoying it? As an instance of the poetic influence of Xmas fare, I venture to reproduce with the author's permission his description of the same incident—

#### A FANTASY FOUNDED ON FACT.

This is the tale of a darkling jheel,  
Where pintail, pochard, mallard and teal,  
Brahminy, widgeon, shoveller feeds,  
Holding high revel among the reeds.  
The sun has set in an angry West;  
The snipe have flown to a fitful rest.  
In the deep cane-coverts that flank the edge  
Of their feeding grounds in the grass and sedge.  
Slowly the flame-light Westward cools;  
On cane-brake covert and glassy pools.  
The night flings wide her shadowy cape;  
Grass-banks fade to an uncouth shape,  
And the mottled waters shiver and gleam,  
In the Star of the Evening's dim white beam.

Silence is fallen on field and furrow ;  
 The fowl at his roost, the hare in his burrow.  
 Lie in the arms of night caress'd,  
 But life on the jheel is never at rest.  
 A myriad crickets, the banks along,  
 Up lift to Heaven their whispered song ;  
 A myriad frogs in throaty choir,  
 Sing a last long dirge to the Sun's dead fire.  
 The quick bats flicker and swerve in flight,  
 From the hungry rush of the swooping kite ;  
 And *Sarus* summons his wayward spouse,  
 With cry discordant, to join carouse.  
 But hark ! a new sound thrills the sky  
 Like the rush of the wind in an ecstasy,  
 Or of cloth-yard shafts, as of yore they flew,  
 True sped from the cord of the six foot yew.  
 Nigher it comes, and yet more nigh,  
 A swirl of shadows o'ercasts the sky.  
 They're here ! They' ve gone ! slow dies the sound,  
 As the duck wing South to their feeding ground.  
 Again that whistle, again the throb,  
 Of the swift-driven wings of that ordered mob,  
 Again the shadows of duck in flight,  
 Glimpsed in the gloom of the gathering night.  
 Gun leaps to shoulder from muzzle a roar—  
 The silence is riven—  
 The duck fear-driven  
 Swing from the flash and skyward soar.  
 But one breaks rank in that rocketing wheel,  
 And swift glissades to the waiting jheel,  
 Hit, hard hit ; the air he thrashes,  
 With strengthless wings—and then he splashes !  
 The splash betrays him—he's gathered in,  
 Or ever to deep reed-haven he win.  
 Again and again is borne on the breeze  
 The whistle and rush of those shadowy V's ;  
 Again, as gun-flash shatters the gloom,  
 The duck wheel up or fall to their doom.  
 And birds, that have settled unseen, take flight  
 On swift-driven pinions into the night.  
 Then follows of wings a drumming more measured,  
 The pace is swift, tho' the wing-beats leisured.  
 The shadows loom larger ; the "*honks*" betray,  
 The grey-goose to water winging their way,  
 The flight is checked as the grey-goose wheel,  
 Choosing their spot on the well-stocked jheel.  
 A shot roars out, another one,  
 And a grey goose drops to a well-held gun.

ROSTAND.

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 No. XVI.—A MUGGER SHOOTING EXPERIENCE.

Some years ago I had an experience when mugger shooting on the River Jumna in the Delhi district, and although I have spoken to many shikaris with regard to this I have never heard from any of a similar one. The facts were as follows : We came across a mugger basking in the sun on a bank at a place where the river was about 150 yards wide. I fired at his neck and hit him,



but just too low to be immediately fatal. The bullet was a .303 soft nosed split and we found afterwards had opened out and caused a large wound in its exit. The mugger rushed in the river and disappeared. A little while afterwards he appeared in the centre of the river at short intervals raising his head and neck out of the water and going down again. My shikari explained that the reason for this was that fishes were nipping at the wound in his neck and his pushing his neck out of the water was to get away from them. The shikari said the fish would probably drive him out of the water sooner or later, so we left the river for over an hour in the hope that this would happen. On returning, however, we found the mugger doing exactly the same thing, so I decided to fire, which I did. I hit him on the head, the bullet glancing off. The mugger made a great swish of water and almost jumped out. Then he lay down on the top of the water and made straight for me. I waited till he was about 3 yards from the bank and then fired between his shoulders. This instantly paralysed him and we dragged him out by the tail. We found even then he was not dead as he held on with his teeth firmly to a lathi and it took a .303 through his brain to finish him. He was a mugger about 13 feet long.

I have never heard of a mugger after being wounded going for the firer, and should be interested to know of any one, having a similar experience.

L. STANSFIELD.

19th February 1924.

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No. XVII.—A NOTE ON THE HABITS OF THE LARGE-SCALED  
EARTH SNAKE *SILYBURA MACROLEPIS*.

This little Earth Snake is very common in Mahableshwar during the rains. It is found chiefly in the rubbish heaps, drains and in the humus of the forest—more commonly at dusk, from which one gathers that it is probably crepuscular or nocturnal in habits, though I have captured one or two during the day. These snakes are most numerous after a shower of rain, which appears to draw them out of their burrows on to the roads and path ways. When alarmed or disturbed in exposed positions these snakes adopt an attitude common more or less to many snakes—they lie perfectly still with the body flattened out to the utmost extent, the object being presumably to escape detection.

The principal food of this earth snake consists of earth worms and small insects, though the former make up the bulk of its diet.

On a walk one evening I picked up one of these snakes and took it along with me. Though extremely slow in movement when on the ground, when picked up it struggled very vigorously. I saw an earth worm on the ground and put the snake down next to the worm to see whether it would attack it. To my satisfaction as soon as the snake noticed the worm it bit it, relaxing its hold immediately afterwards; as the worm continued to wriggle the snake bit it again, whereupon the worm ceased its struggles and lay quite still apparently paralyzed. It might be mentioned here that Revd. Father Caius, S. J., a bio-chemist, who is devoting a considerable amount of attention to the study of snake venoms, informs me that many of the *Silyburidae* secrete a quantity of venom in the parotid glands, which mixing with the saliva, possess sufficient virulence to enable these reptiles to easily overcome their prey. To continue with my experiment, after the worm ceased its struggles the snake commenced swallowing the worm head first. In about two minutes the whole process was complete, a great quantity of earth was forced out of the worm in the act of swallowing, much of which adhered to the mouth of the snake. This the reptile got rid of by rubbing its mouth this way and that on the ground. I picked it up after it had finished its meal, took it home and discovered later that a further quantity of mud had been ejected by the snake after I had put it away.

The natives are extremely afraid of these snakes and as usual have associated it with legendary beliefs of a most alarming character ; a woman who saw me pick one up was horror stricken at the sight and gave vent to screams which promptly brought a crowd around all shouting and gesticulating . On asking what ailed them I was told that the snake would make a knot round my hand and that I would never be able to get out of it.!

When the soil becomes dry these earth snakes burrow down into it. I am inclined to believe that they use their abbreviated tails as stoppers to close the upper ends of their burrows. The burrow it may be explained is not vertical but runs an oblique course into the ground. The tail of a *Silybura* also ends obliquely and when the snake is buried in its burrow the upper surface of the end of the tail lies flush with the ground and thus forms an excellent stopper.

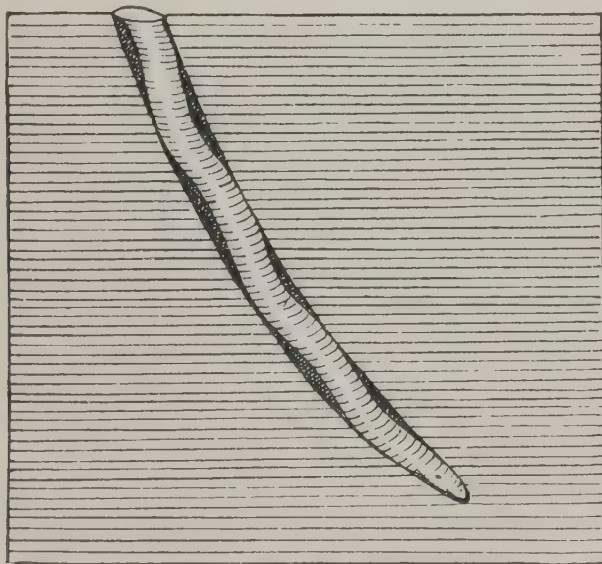


Fig 18—Diagram to illustrate method of closing burrow. The oblique end of the tail lies level with the surface of the ground.

I found one of these snakes in exactly this position and was at once struck with the possibility, that this was an explanation to the abrupt and oblique termination of the tail, which is a characteristic feature in snakes of this family. Further may it not be possible that the rough papillæ with which the ends of the tail of the *Silyburids* are covered, giving them a rasp like appearance, are of a sensory nature and would therefore be in the nature of an additional safeguard warning the reptile against possible intruders ? Further the end of the tail is tough and coarse—quite different to the smooth and tender texture of the rest of the body. So tender is the texture of the epidermis that these snakes appear to be unable to stand strong direct sunlight for very long. Numbers of them dug up by the road menders become scorched and perish a short time after exposure, hence the toughening of the epidermis at the end of the tail, which while the snake lies in its burrow remains continuously exposed at the surface.

In captivity they should be kept moist with damp earth and fed on earth worms, under these conditions they survive for a long period.

BOMBAY NATURAL HISTORY SOCIETY,

CHARLES McCANN.

January 1924.



No XVIII.—FURTHER NOTES ON THE BREEDING HABITS  
OF THE PEARL SPOT FISH (*ETROPLUS SURATENSIS*).

In my notes on the Cichlid Fishes of Malabar (Madras Fisheries Bulletin, Vol. XII, No. 5, 1920) I have stated that the Fish breeds twice a year. Experiments were afterwards conducted to find out whether the fish could be made to breed more often. The results of these experiments undoubtedly answer the question in the affirmative. A pair of breeders was singled out and kept in an aquarium tank. The record of the successive spawnings is given below:—

- 9-11-22 .. The pair spawned for the first time and the young were allowed to be cared for about 3 months until they left the parental care.
- 7- 4-23 .. Spawned the second time and the larvæ hatched out were removed on 12th April 1923.
- 6- 5-23 .. Spawned the third time. The larvæ removed on 10th May 1923.
- 17- 5-23 .. Spawned the fourth time. The larvæ removed on 21st May 1923.
- 4- 6-23 .. Spawned the fifth time. The spawn removed on the same day.
- 27- 6-23. .. Spawned the sixth time and the spawn removed.
- 14- 7-23 .. Spawned the seventh time and the spawn removed.
- 21- 7-23 .. The pair died on account of the washing in of lime into the tank.

The fish is admirably adapted for pond life and is found to thrive well under novel conditions in the irrigation tanks of Shencottah where they have been introduced. The greatest difficulty is now being experienced in acclimatising the fish taken from saline and brackish waters to fresh water conditions and in transporting them to long distances. The larvæ, before the absorption of the yolk sac, can be kept quite safely in small earthen vessels for 7 days and can be conveniently transported in numbers to very distant places. If the attempt to feed and preserve a reasonable number of larvæ far beyond the critical period after the resorption of the yolk until they attain the proper size for stocking is successful most of the difficulties can be said to have been overcome, as a single pair of breeders can be utilised to raise large quantities of larvæ.

QUILON,  
19th January 1924.

N. P. PANIKKAR, B.A., F.L.S.,  
Fishery Inspector.

## PROCEEDINGS

PROCEEDINGS OF THE MEETING HELD ON 13TH  
NOVEMBER 1923.

A meeting of the members of the Bombay Natural History Society and their friends was held in the Prince of Wales' Museum, Bombay, on Tuesday, the 13th November 1923 at 6-30 p.m.

The following 22 new members were elected since the last meeting :—Miss C. G. Kershaw, Ceylon ; Capt. J. H. Hislop, M.C., I.M.S., Tibet ; Lt. S. F. H. Williams, Bombay ; Capt. R. Hay, I.M.S., Nasirabad ; Mr. H. M. Glover, Rawalpindi ; Mr. J. I. Alfrey, Bombay ; Mr. C. E. D. Mears, Indore, C. I. ; Commander George Wilson, R.N., East Indies Station ; Major R. H. Macdonald, Bombay ; Mr. V. Aquino, Bombay ; Lt. J. A. Theobalds, Rawalpindi ; Mr. F. W. Withers, I.F.S., Rangoon ; Mr. L. A. McCard, Burma ; Mr. K. Ringger, Bombay ; Capt. S. N. Hayes, I.M.S., Dera Ghazi Khan ; Major H. G. Martin, Simla ; Mr. V. G. Bell, England ; Lt.-Col. B. L. Cole, Jhansi ; Major J. C. Tate, I.A., Chhota Udepur ; Mr. A. P. F. Hamilton, I.F.S., Sultanpur ; Capt. C. Cardew, R.E., Aden ; Miss N. F. Loch, Hyderabad, Deccan.

Mr. R. A. Spence, the Honorary Secretary, reported that 22 new members had joined the Society since the last meeting held a month ago. This increase in membership was very encouraging and was an acknowledgment of the value of the work that the Society was doing ; he wished at the same time to thank those members who had made a special effort to bring in new members on our roll and he asked those present to help the Society in the same manner. Since the Society had lost the grant, it used to receive for its ordinary work, from Government, it had become more dependent than ever on the individual efforts of its members. It had been his policy to popularise the work of the Society particularly in regard to the Journal by the inclusion of illustrated articles and papers which would interest the lay reader, and the Journals issued during the current year were proof of what had been accomplished in this way. The number now in the Press contained several interesting articles. Among them one on "Animal Life in the Ganges" by Dr. Annandale which formed the subject of a lecture delivered at the Indian Museum sometime ago, and Capt. Hingston's very interesting serial on "The Red Ant." He was glad to say that the Society's monthly meetings at the Prince of Wales' Museum were becoming more and more popular. Members were always welcome to bring their friends to these meetings and he hoped that by their doing so they would make the Society better known. Though the Society was known as the Bombay Natural History Society the list of local members was comparatively small and he was certain that if those present made up their minds to help, this defect would soon be remedied.

## THE EXHIBITS.

Mr. S. H. Prater, the Curator, exhibited some mounted birds and casts of fish that had recently been prepared for the Museum in the Society's work rooms. It was his intention to prepare a series of mounted birds illustrating the Game Birds of India and, as a result of appeals sent out, the Society had recently received a handsome pair of Monal and Koklass Pheasants from Mr. Whistler, while further additions to this series had been promised. He asked those present who had the opportunity of shooting during the coming cold weather to remember that the Society would be glad to receive specimens of any Game Birds obtained by them that would be suitable for this purpose.

As regards Mammals the Society had recently received a complete skin of a Kashmir Barasingh (*C. cashmirensis*) for mounting from Col. Burton, who had also promised to send a pair of Gorial. Major C. H. Stockley, who was at pre-



sent collecting for the Vernay expedition had also obtained a number of specimens for us, and Major Bailey had secured a complete skin of a Great Tibetan Sheep (*O. ammon hodgsoni*). All these specimens would, he hoped, adorn the Mammal Gallery in the near future. He reminded those present and the public in general that the exhibits at present arranged in the Mammal Gallery were of a purely temporary nature; as fresh specimens were mounted the flat skins would gradually be withdrawn. It meant either having a temporary exhibition of this nature or closing the Gallery to the Public until it was ready. The cases for the bird gallery were now ready and the work of preparing the mounted specimens was being pushed on but the whole matter was a question of time and money.

#### ILLUSTRATED LANTERN LECTURE.

Mr. J. Addyman, M.L.C., gave those present the benefit of his long experience in a lecture on the Culture and Life of the Honey Bee. Mr. Addyman's lecture was suitably illustrated by his excellent series of lantern slides. The lecturer was heartily thanked by those present.

#### PROCEEDINGS OF THE ANNUAL MEETING HELD ON 6TH APRIL 1924.

The annual general meeting of the members of the Bombay Natural History Society was held in the Board Room of the Prince of Wales' Museum on Thursday evening at 6 p.m. The Rev. E. Blatter, S. J., presiding.

The following 29 new members were elected since the last meeting:—  
Mr. Radhakant Malaviya, M.A., LL.B., Bombay; Mr. G. D. Sutherland, Bombay; Lt. K. L. Bodenham, Delhi; Mr. H. H. Sawyer, Bombay; Capt. M. R. Metcalfe, I. A., Deoli; Kumar Shri Nutversinhji of Gondal, Jetalsar, Kathiawar; Capt. D. Moncrief Wright, Quetta; Mr. A. H. Berriff, Simla; Mr. H. F. Mooney, I.F.S., Sambalpur, B.—N. Ry.; Mr. W. J. Barron, Tavoy; Maharaj Kumar Fattehsingh of Ali Rajpur State, Dohad, B. B. & C. I. Ry.; Mr. E. V. D. Chislett, Sion, Bombay; Mr. W. N. R. Kemp, Champaran; Mr. E. J. A. Swan, Papun, Burma; Mr. G. T. Burrows, Papun, Burma; Mr. R. W. H. Davies, I.C.S., Karachi; Mr. D. E. Reuben, I.C.S., Cuttack; Mr. J. W. Rowland, Karachi; Mr. N. K. B. Kurupp, B.A., M.Sc., Quilon; Mr. A. W. J. Symes, Sabarmati; The Right Hon'ble Sir Leslie Wilson, P. C., G.C.I.E., C.M.G., D.S.O., Bombay; Mr. Alwyn Ezra, Bombay; Capt. P. R. H. Skrine, Jhansi; Mr. C. C. Demetriadi, Karachi; Mr. W. H. Workman, F.Z.S., M.B.O.U., Ireland; Mr. Hamid Khan, M.Sc., Lahore; Mr. Geo. B. Morton, Calcutta; Mr. Stephen Calvocoressi, Bombay; Mr. A. McLean, Pyinmana, Burma. The appointment of officers for the ensuing year was as follows:—

Patron:—H. R. H. The Prince of Wales.

Vice Patron:—H. H. The Maharao of Cutch.

President:—H. E. Sir Leslie Wilson.

Vice-Presidents:—Sir Norman Macleod, the Maharao of Cutch, and the Rev. E. Blatter.

Managing Committee:—Mr. T. Bainbrigge Fletcher, F.E.S., Pusa; Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar; Mr. R. D. Bell, C.I.E., I.C.S., Bombay; Mr. J. P. Bradshaw, Bombay; Lt.-Col. W. H. Evans, R. E., Simla; Major F. C. Fraser, I.M.S., Mercara; Dr. N. Annandale, Calcutta; Dr. Gravely, Madras; Mr. J. E. B. Hotson, I.C.S., Bombay; Prof. V. N. Hate, M.A., Bombay; Mr. C. M. Inglis, Darjeeling; Mr. H. F. Lodge, Bombay; Mr. R. C. Lowndes, Bombay; Mr. F. Ludlow M.A., M.B.O.U., I.E.S., Tibet; Sir Henry Macnaghten, Kt., M.A., M.L.C. Bombay; Mr. J. G. Ridland, Bombay; Mr. P. M. D. Sanderson, Bombay; Major C. H. Stockley D.S.O.; Dr. D. A. Turkhud, Bombay; Major J. Taylor,

I.M.S., Rangoon ; Mr. H. Whistler, F.Z.S., M.B.O.U., C.F.A.O.U., Punjab ; Mr. W. D. Cumming, Quetta ; and Col. F. Wall, I.M.S., Coonoor.

Honorary Treasurer :—Mr. T. A. M. Hill.

Honorary Secretary .—Mr. R. A. Spence. F.Z.S.;

### ACCOUNTS FOR 1923.

The Honorary Treasurer, Mr. T. A. M. Hill, who had been on leave for a few months was welcomed back by the members. Mr. R. C. Lowndes who had been acting for him placed before the meeting the audited Statement of accounts for the year 1923 and stated that at the close of the year 1923 the number of members on the books were :—Life Members 155 and Ordinary Members 1,131. During 1923, 186 Members resigned, 93 Members joined and 2 rejoined.

An examination of the Receipts of the Society during the year 1923 shows that subscriptions were approximately Rs. 1,000 less than in 1922, whereas the number of entrance fees shows a small increase over those received last year. The decrease in the subscriptions is apparently due to the fact that twice as many Members resigned from various causes as joined the Society during the year. The number of members who availed themselves of the privilege of becoming Life Members of the Society has still further decreased this year and the receipts on this account are some Rs. 1,250 less than in 1922. The increased subscription has evidently had a deleterious effect upon the membership of the Society, though it is hoped that this is only temporary and it may be mentioned that the number of members who have joined the Society has shown an increase during the last 6 months.

Turning to the expenditure account the most important item of expenditure is the cost of printing the Journal which shews a further increase of nearly Rs. 1,500 over last year, and now costs Rs. 11,400 more to print than it did three years ago, an increase of more than 100 per cent. over 1920 printing charges. The Honorary Secretary has already taken this matter up with the Publishers and it is hoped to obtain some reduction in this item during the current year.

The Prince of Wales' Museum continue to pay 50 per cent. of the salaries of certain of the staff employed by the Society but the salaries have increased during the year by Rs. 3,200 which is due to the gratuity and half pay given to Mr. Ellison on his relinquishing his appointment as curator of the Society on account of ill health. This item will, therefore, not recur in 1924.

Expenditure under practically all other heads shows a decrease and the Honorary Secretary is to be congratulated on the economies he has been able to effect in this respect.

A summary, however, of the receipts other than what should be treated as Capital, and amounts received on account of Game Books, etc., as compared with the Revenue expenditure of the Society, appears to show a deficit on the year of very nearly Rs. 10,000. This can only be improved by an increase of the membership of the Society, and a reduction in the expenditure, principally in the cost of printing the Journal.

With regard to the sale of books, charts, etc., most of the accounts appear satisfactory with the possible exception of the sale of Game Bird Books. There is for this still an amount of Rs. 16,199-1-0 due to publishers, and in addition the Society appears to be out of pocket by a further sum of Rs. 15,946-2-0 at the end of last year. Very little more than half the bound copies have as yet been sold, which accounts for the



above position, but if these and the unbound copies can be sold the Society will not only cover out of pocket expenses, but will make quite a reasonable profit. Recent sales have, however, not been as promising as were originally hoped.

#### MAMMAL FUND.

The fund opened with the balance of Rs. 21,745-15-9, but Rs. 2,922-11-7 only having been received during the year it closed with a balance of only just over Rs. 10,000. Salaries will again be less this year, but I cannot add to what was said last year, namely, that as it is unlikely that fresh funds will be forthcoming it will be necessary to rely in future principally on work being done for us by honorary workers.

The formal business having been concluded the members adjourned to the Natural History Section of the Museum. Considerable interest was shewn in the many recent additions mounted by the Curator and his Staff.

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STATEMENT of ACCOUNTS from 1st January 1923 to 31st December 1923.

We have seen a letter from the National Bank of India, Limited, to the effect that the above Securities were held on Society's behalf on 31st December 1923 as also a certificate from the National Bank, London, for the balance with them.

BOMBAY, 12th February 1924.

Examined and found correct.  
(Sd.) A. F. FERGUSON & Co.,  
*Chartered Accountants, Auditors.*

(Sd.) R. C. LOWNDES,  
*Honorary Treasurer,*  
Bombay Natural History Society.

(Sd.) A. F. FERGUSON & CO.  
*Chartered Accountants, Auditors.*

# PROCEEDINGS.



## MAMMAL FUND ACCOUNT.

## BOMBAY NATURAL HISTORY SOCIETY.

## STATEMENT of ACCOUNTS from 1st January 1923 to 31st December 1923.

	Rs. a. p.	Rs. a. p.		Rs. a. p.	Rs. a. p.
OPENING BALANCE ON 1ST JANUARY 1923.			Salary of Mr. Wells .. ..	.. ..	4,200 4 0
Fixed Deposit with the Central Bank of India, Limited, Bombay .. ..	20,000 0 0		" Mr. McCann .. ..	.. ..	3,200 0 0
On current account with the National Bank ..	1,745 15 8		" Mr. LaPersonne .. ..	.. ..	1,179 0 6
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